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VOL. XVII MAY, 1930 No. 5

EDITORIAL

If you want a better understanding of the practice of electro-chemistry;

And you want to participate in a real program of progress in your profession;

And you are really a seeker of knowledge and truth about plating practice and theory; and would know what the wisest and best men in electro-plating industry have taught in the past year;

And are interested in the mysteries of this profession and its evolution to perfection;

And it is your desire to extend your mental vision and discover new things in plating art, developing a greater desire to serve your fellow workers;

And logic and reason appeal to you, you love truth, despise error and hypocrisy; why do you not join the American Electro-Platers Society, and if you are a member, why not attend meetings regularly? The above mentioned society seeks to impress its members with above philosophy, by thoughts and words; it is the apostle of liberty from plating mysteries, and no one who belongs to this society and attends its meetings can long remain idle, or ignorant, but will become strong and confident in ability.

If not a member join now. If you are a member attend its Branch and Annual Meetings, and enjoy its benefits.

DOING THINGS FOR THE ELECTRO-PLATING INDUSTRY

By Charles H. Proctor

Read at Chicago Branch, January, 1930

In October last I was very much interested in the Publishers' Page of "Metals and Alloys," the short article under the caption of "Let's Have Your Views." The first issue of this excellent publication appeared in July.

Abstracting from the October issue, I was much interested in the following statement gleaned from results of interviews had with representative men at several conventions and other personal interviews by a representative of "Metals and Alloys," viz:

"While all the encouraging and complimentary things said to us in these interviews were welcome and decidedly cheering, we valued even more, some of the intelligent critisisms that various people took the trouble to present to us in detail.

"The most frequent criticism was a suggestion that we steer clear of making the paper too 'technical' and that we devote at least a part of our space to articles interesting to so-called 'practical' men throughout the metallurgical industries such as foundry men, electro-platers, etc.

"We intend to profit by these suggestions and have already taken steps to secure such material because we feel that 'Metals and Alloys' should have something to say to all types of people having any interest in metallurgy and the use of metallurgical products.

"We have had enough experience in selling 'advertising' in other technical publications to realize that the average advertising manager instinctively shies at a paper which appears to him as being extremely technical, or as he more usually puts it 'highbrow.'"

The reason for my writing this paper is for the specific purpose of eliminating from electro-plating publications and from the electro-plating industry and from the American Electro-Platers' Society, a lot of such "highbrow" papers, technical, if you so desire to call them, which tell you all about the theory of doing things but tells you nothing about producing results on a commercial

economic production basis which after all means "practical" results in the fullest measure.

Theory is but thought until one is enabled to put the thought, the theory, into commercial practical results or production. If you do not believe so go and talk to your plant manager, to your superintendent and commence to theorize as to how you think you can do things that you elaborate on. When he wishes to know whether you can produce the results you have outlined to him, you tell him no, but you have the theory that it can be done; he will politely tell you "We want results, not theory, you know." This is absolutely true in the electro-plating industry. You must know how to do things and how to produce results wanted, at a minimum of cost, and if you cannot produce the results then some one else will fill your position who can do what you cannot do. These are cold commercial facts that all the theory in the world cannot eliminate from commercial production at a minimum of cost.

We often hear that the chemist will eliminate the electro-plater due to his superior knowledge of the chemistry of the electro-plating solution and its control. On November 23rd last I had the pleasure of presenting a paper before the New York Branch of the American Electro-Platers' Society, entitled: "Taking the Bunk Out of Electro-Plating Industry" and incidently the electro-platers society. I anticipate that this paper will eventually be published in the "Monthly Bulletin" of the Society. From the ovation received after the papers presentation it would appear to its author that its hearers were satisfied that there is a lot of "bunk" as he outlined.

Experience, you know is the best teacher in the world. There is nothing like experience. It costs a lot of money some times to gain practical experience, and experience that cost most is longest to be remembered, but after all the cost is worth while when the knowledge has been gained that can be put to commercial results and production.

If we summarize the results in defining what a successful modern electro-plater should know then this is the answer:

(a) He should have learned thoroughly the art of electro-plating in all its details, be able to deposit any commercial metal and apply any chemical finish on any metal.

(b) He should be able to analyze his plating solutions chemically and to know what plating formula will produce the maximum

results under intensive commercial production at a minimum of cost. Chemical knowledge and control of his plating will enable him to produce constant results every day, under known conditions and when analysis of solution does not overcome problem then experience gained through years of application will tell him what further additions must be made to his solutions to correct them when the deposit goes wrong and therefore make them right.

When pitting of nickel deposits occur, when peeling of the deposits results, which all too frequently is laid at the door of the manufacturers of metal cleaners, and when analysis of the solution does not tell you "why" these problems occur or how they occur, but you have learned that such results are due to hydrogen in excess which results from solutions of high metal concentration and high current densities now used in intensive production of plated products at a minimum of time, then you certainly must know what to do.

To give you a basic idea as to what is required to control hydrogen conditions in high density nickel solutions operated at temperatures up to 130 deg. Fahr., firms that manufacture automobile bumpers and auto radiator shells, use as much as 30 barrels of 25 volume hydrogen peroxide per month, others use an equivalent amount of sodium perborate which they convert to hydrogen peroxide themselves. In copper plating high carbon steel from high density copper cyanide solution pitting and pealing of the copper deposit, can be traced to the same evil factor "hydrogen" which I once termed the "devil" of the plating solution.

(c) He should study Faraday's and Ohm's laws so that he can determine what current densities are best adapted for the various metal deposits he must produce. Electrical control of the plating solution and the plated deposit is even more essential than analysis of the plating solution if he desires to reproduce continuously "standard" plated deposits of known thickness he must know to a certainty the voltage, the amperage and the time factor that is required to maintain such results. Guess work and rule of thumb methods will then be entirely eliminated and a man with such knowledge as outlined in a, b, and c can then be considered as a truly modern electro-plater. Chemists and metallurgists and engineers, too, realize that without the knowledge gained from years of practical experience in electro-plating methods they are but as

"figure-heads" and "highbrows" as I have already referred to in the outline of this paper.

Doing things for the electro-plating industry then is the essential factor for commercial results. I always enjoy listening to our good friend and wise counsellor, Dr. Oliver P. Watts of the University of Wisconsin. When you follow carefully what he explains to you in his interesting talks you will make note that he always says "You can do this." He does not hand you a promissory note such as many orators do when they address you on electro-plating matters, when they state that "If you can do this or that, then, of course, you can accomplish a purpose," but when "if" is attached to "you can," a hundred chances to one is that what the author has in his mind as a theory cannot be done in practice.

I should prefer to listen to more of the Oliver P. Watts type of men's interesting talks in his quiet way, than to all the presumists that talk before the electro-platers society and when they are through find that the things they elaborate on cannot be done. We are interested in doing things for the electro-plating industry. Papers presented should teach us this.

Self-praise, I know, is no recommendation. It belongs to the demagogue class I spoke of a few weeks ago in Philadelphia at the annual educational session and banquet of the Philadelphia Branch. But when a man has been connected with the electro-plating industry for nearly forty years as I have, his visions of other days carries him backwards and he tries to discern through the mist of elapsed years "what" he has done for the good of the cause he has the honor to represent. For twenty years I have been using my pen for the good of the cause and doing the things for the plater and the industry of which they are an integral part.

It is not necessary to re-state the fighting chance I took several years ago single handed to prevent control of the cadmium plating industry which has become of great commercial importance in America, when I established prior art through the publication of the Russell and Woodrich patent of 1849 and also the splendid article on "The Electro Deposition of Cadmium" by the late Emmanuel Blassett, Jr., as published in The Metal Industry, December, 1911, which re-established prior art and enables any one to operate a cadmium plating solution commercially without violation of any succeeding patent. There exists today only one

real patent that can be considered as a valid factor and that factor is an anode that contains as the controlling factor metallic mercury on the basis of 98.99 per cent cadmium and 2 to 1 per cent mercury.

I have fought my way through the maize of chromium plating with the same weapons, public opinion, as I had previously done with cadmium, fearless and free in the belief that I was right in defending commercial chromium plating established in the expired patent of Placet and Bonnet. Establishing, as we have defined it, prior art of the work of Carveth and Curry who were in accord with the findings of Placet and Bonnet and substantiated their claims that commercial chromic acid could be used in connection with sulphuric acid as the sulphate factor and bright lustrous chromium deposits resulted that should eventually have great commercial values, of the work of Sargent financed by Dr. Bancroft and Carveth and Curry, resulting in the chromium solution with minor modifications that is in use all over the United States today.

More than four years ago I mentioned to many of my friends who followed my ideas covering a distinctive chromium plating solution based on Sargent's original solution, that I would for their interests and the interests of commercial chromium plating make every effort to obtain a patent on a distinctive chromium solution which would protect their interests against encroachment and my company, who I have the honor to represent at this meeting, as well as mine. The claims have been allowed covering the solution and anodes, your protection is mine, and all my friends included. This is "doing" things for the electro-plating industry.

A year ago this time I presented a paper covering a duo-deposit of duo zinc and tin for the benefit of the electro-plating industry and gave all details as to plating solution, etc., and its control. When you see a radio unit that is mounted on a steel plated base and which has a color approaching scratch-brushed silver in whiteness and lustre you will know then it is a duo-zinc and tin deposit that is produced at less than half the cost of straight cadmium deposits.

As a solution of the problem of high cost of cadmium and still maintain the maximum resistance against rust and atmospheric oxidation of malleable iron and gray iron and steel products, the Roessler & Hasslacher Chemical Company introduced in large

eastern plant a duo-deposit of cadmium, zinc and mercury, 50 per cent cadmium, 48 per cent zinc and 2 per cent mercury. The solution itself approximating the same equivalent basis. The firm in question plates twelve tons of small parts of conduit fittings made from malleable iron and steel per day. The cost of the anode is slightly more than one half of that of an anode made from pure cadmium, when you consider the difference in the atomic weight of cadmium and zinc, this special anode does not cost half as much as cadmium but the rust resistance is much greater.

You can realize the enormous saving that results to the firm in question in the cost of a year's time by using this new alloy.

Another innovation in doing things by the company that employs me for the electro-plating industry, they have put out a new alloy and solution which we have given the name of "Durobrite." It is really due to a high zinc-low cadmium anode, 90 per cent zinc, 10 per cent cadmium. In this unusual deposit it would appear that the cadmium acts as a colloidal metal factor resulting in the bright lustre finish elaborated on.

Doing things for the electro-plating industry resulted in a distinctive bright white lustre deposited metal for distinctive metal shoe buckles attached to white leather shoes which will be all the vogue in women's footwear this summer. For years the chrome alum tanned white shoe leathers have attacked all electro-plated deposits applied to low brass shoe buckles. Cut steel, silver nickel, any metal that gave a finish comparable to the white leather of the shoe was attacked and disintegrated by the action of the chrome alum in the leather and moisture of the atmosphere. Two well known firms in the east have copyrighted as trademarks the names "Tarno" and "Plateen" finish. The finish was introduced by the author of this paper and consists of a white bright lustre electro tin plated deposit obtained from the electro tin plated solution given to you in Chicago a year ago.

Burnishing in oscillating burnishing barrels, better known in the east as tumbling barrels, with plenty of steel balls and "burnishine" burnishing soap solution are the lustre producing factors.

Doing things for the plating industry resulted in two high density nickel and copper cyanide solutions being introduced by the author for the benefit of the automotive industry, that wanted such solutions which could be operated at a minimum of 50 amperes

per square foot of surface area. In experiments carried out at the Research Laboratories of the company that employs me at Perth Amboy, N. J., with these solutions, current densities have been carried as high as 100 amperes per square foot of surface area. Sections of automobile bumpers plated in such solutions for a total of 19 minutes, including three minutes in our standard chromium solution with two buffings included applied to the copper deposit and final nickel deposit, the quadruple deposits consisting of nickel, copper, nickel and chromium, when exposed to the action of a standard 20 per cent salt spray test solution, the break down showed that rust spots did not occur until after five hundred hours exposure to the test.

What I have elaborated on in this paper should I believe be my answer to "Doing Things for the Electro-Plating Industry."

In a later paper I shall give all solution details covering the deposits mentioned in this paper, so that "Doing things" for the electro-plating industry will be more complete.

Some of the papers written years ago by the writer and which today have all the hall marks of today's modernism in the electro-plating industry are:

"A Simple Method of Regulating Anode Surfaces in the Plating Bath," illustrated with drawings." The Metal Industry, July, 1910.

"The Rapid Deposition of Nickel by Continuous Filtration Using Felt Bags and a Mechanical Pumping Device." Some time in 1908 (exact date is at present lost).

"Some Methods Used by Electro-Platers to Produce Bright Nickel Deposits." (Cadmium was first mentioned in this article.) The Metal Industry, January, 1916.

"Speeding Up the Electro Deposit." (The evolution of the single nickel salts in still and mechanical plating solutions.) The Metal Industry, February, 1916.

"How We Can Best Adopt 'Standardization' for Plating Solutions and Products in Individual Plants." The Metal Industry, July, 1919.

"American Electro-Platers' Society and the Manufacturer." The Metal Industry, August, 1920.

"Guaranteed Electro-Plating." A plea for better electro-plated products in the automotive and other industries that should carry

the guarantee of its wearing qualities by the manufacturer. The Metal Industry, August, 1923.

It is interesting to note that the above title covered an address made at the convention of the American Electro-Platers' Society in Providence, R. I., July 2 to 5, 1923, and contained an important paragraph which can certainly be considered modern in this year of grace, 1930, and is as follows:

"It is my desire that this 1923 convention of the American Electro-Platers' Society go on record in support of better plated products, which will be more enduring under the rigid service that all plated products must endure under our modern conditions, and that the application of electro-plated surfaces shall be improved so that the maximum of wear can be assured to the consumer who must pay the price of poorly plated defective products."

Nearly seven years ago and the statement still emphasizes "Doing Things for the Electro-Plating Industry."

THE CONTROL OF H ION CONCENTRATIONS IN SOLUTIONS FOR NICKEL DEPOSITION

By Dr. A. K. Graham

Read at Phil. Annual Meet, November, 1929

DR. A. KENNETH GRAHAM: As you probably recall, the earliest references to the control of acidity in nickel solutions relate how litmus paper was used to test that acidity. And we now know that merely indicated that the solution was either acid or alkaline to the indicator, litmus.

About 1914, the American Hardware started some work, and they developed a method of controlling the acidity of nickel solutions by titrating that solution with standard acid and an indicator —I think the indicator used was sodium alizer and sulphonate and they successfully controlled their solution by that method.

Between 1914 and about 1922, Mr. Sizelove had done considerable work on the analysis of plating solutions, and one of the things that he did was to develop a method of control of the acidity in nickel solutions by titrating that solution with acid and methyl red as an indicator. The two methods are quite similar. Mr. Sizelove expressed his results rather ingeniously and I will

refer to that later, but the cardinal fact is that both concerns independently, or both people independently by those methods were able to successfully control their nickel solutions and produce good work under practical conditions.

About 1924, Mr. Thompson, of the Bureau of Standards, suggested the use of Brome cresol purple as an indicator, and that that be used in connection with standard acid in titrating acidity in nickel solutions. To the best of my knowledge, that only enjoyed a limited application. For no reason, apparently, the other method only enjoyed limited applications. I might suggest that the real reason for that is probably the fact that from 1914 to 1924, the platers of the country knew considerably less about analysis of plating solutions than they know today. Consequently, they couldn't avail themselves of the information that was at their disposal. In addition to that, in later years the titration method used by some of the men I have referred to gave a result which could not be checked or would not give agreement with other methods of controlling acidity, such as the pH control method. There was lack of agreement. That also probably mitigated against the adoption of the titration method for control of these solutions.

It was about 1922 that Thompson at the Bureau of Standards advocated the use of colorimetric standards for the control of the pH of nickel solutions, using brome cresol purple as the indicator. Since that time, that method has enjoyed general use and popularity. It has served to give a much more satisfactory control of the hydrogen ion concentration of the nickel solutions than anything heretofore, and it was easily learned by the plater, and consequently has grown in favor and is now more or less generally used. As we gathered more information on the application of this method, we found that there were some variations that couldn't be explained between results in different plants, and in imparting knowledge as to how you best operated and how another man attempted to reproduce your results. About 1924 or a little later, LaMare of Columbia University at a meeting of the American Electro-Chemical Society, recommended the use of quinhydrone for the measurement of pH by an electrometric method, and Mr. Youdon, of the Boyce-Thompson Institute, of Yonkers, N. Y., was applying this method in the testing of the pH of soils.

The method was taken over by Mr. Pitchener, of the American Chain Co. and applied to nickel solutions.

Since that time, a number of methods of measuring the pH of nickel solutions, electrometrically, using quinhydrone have been developed and have even been put in use in plants. The colorimetric method has the advantage of being rapid, only requiring a small expenditure of money for the equipment, and easily learned. The electrometric method is capable of giving more accurate results, and yet it does require more expensive equipment, and a little more technique in operating.

With the development of these two colorimetric methods jointly, it became apparent that there was a variation in the results obtained by the two methods on any one solution. That led to the investigation which Dr. Blum and some others completed last year which was published in the spring meeting of the American Electro-Chemical Society, at which time it was shown that certain things gave errors by the colorimetric method which by the electrometric method were eliminated to a large degree, and the general conclusions were that for research work where you wanted to record the absolute pH value of nickel solutions, that the electrometric method with quinhydrone gave the most satisfactory results for ordinary operation. However, for plant control the colorimetric method sometimes was a very satisfactory means of controlling the pH, but we should recognize in using that method that the values given are somewhat higher numerically than the absolute true values which are recorded by the electrometric method, approximately five tenths of a pH unit higher for the general run of solutions.

Now in that paper, a number of solutions of the more or less common compositions have been studied and the actual salt error, or deviation of the colorimetric measurement from the electrometric measurement have been recorded there and can be consulted, if need be. That study focussed attention on the accuracy of pH measurements. It also focussed attention on the fact that in the average plating operation, the pH will vary within certain limits.

Now we have recommended for a number of years among ourselves (I am speaking of the old platers) a value of pH of about 5.8 for the ordinary type of cold nickel solution in still plating, and yet we realize that if that pH dropped to 5.6 or if it should go up to 6.0, we get satisfactory nickel plating. If it goes much

below 5.6, we have trouble due to too great an acidity; if it goes much above 6.0, we have trouble due to too great an alkalinity; the deposit might become dark, and so on. But we have a limit on either side of 5.8 of approximately four to five tenths of a pH unit within which we can satisfactorily operate.

Now for plant control, therefore, there is no use in going to any great accuracy or trying to define things more closely than that when we realize that that is what we are actually doing and getting away with it satisfactorily.

Now in recommending the correction of the acidity of the nickel solution, where you measure the pH and find it to be about 5.3, as an example, and you want it to be 5.8, the most that you can do is to tell the party concerned that they must add a certain amount of ammonia, preferably ammonia (you can add other things) or of a base of some kind, nickel carbonate, nickel oxide, but add a certain amount of hydroxide to raise that pH from 5.3 to the desired value of 5.8. You can't tell them how much. The quantity depends entirely on the composition of your solution, and that varies in each different plant, and in different uses, so that you can only tell him to add the material until after additions the solution, tested with, say, a colorimetric set, will give a pH reading of about 5.8. Now that means a cut and try method. After you operate a solution in your own plant for a period of time, you become so acquainted with that solution and the buff characteristics which determine how much acid or alkali are needed to change a given value of pH, that you can say, "Well, to change it from 5.3 to 5.8, I have to add so many c.c.'s of concentrated ammonia per gallon." You might learn from experience. But the fact remains that you usually have to experiment to be certain, and test it afterwards.

Now on a large tank, where you have a large automatic installation with say a 10,000 gallon nickel solution, it is some job to add ammonia and stir it in the entire solution and measure the pH and be sure you are up to the value you want. It is time consuming. On the other hand, if you had a means of actually measuring not only the pH, but the quantity of acid or alkali required to make that adjustment, at one and the same time, you would make it much simpler and it would be much more satisfactory.

The titration method offers this advantage. It was because of the fact that there was reported disagreement between control

by the titration method and the colorimetric method that the titration method was again investigated. It was found that by the method suggested by Mr. Sizelove, using methyl red and standard acid, that one was able to correct the pH of a solution to well within two-tenths of a pH unit, which is plenty good enough. Certainly comparable to any colorimetric method as far as adjustment of pH. At the same time, in making the titration which enables you to correct the solution to that pH value, you are determining the amount of acid or alkali required to actually effect that change in your solution. To illustrate the point, take our solution with a pH of 5.3. We titrate it with methyl red and we might find that it is slightly alkaline to methyl red and it might be equivalent in alkalanity to about 1 c.c. of concentrated commercial ammonium hydroxide per gallon of solution. They are the units in which Mr. Sizelove expressed it, and they are very satisfactory for our use.

Now if we want to operate at 5.8 pH instead of 5.3, we must have it more alkaline, and if we once determine how many c.c.'s of ammonia were required in a solution, when titrated with methyl red to give a pH reading of 5.8 on a colorimetric instrument, we have a value in terms of the cubic centimeters of ammonia per gallon of solution which can be used as a standard alkalinity for controlling that solution. It has been found, in certain plants, that if we keep our solutions for still plating where the nickel is about 3 ounces per gallon, the ammonium chloride about 2 ounces, boric acid about 2 ounces per gallon, and about 3½ c.c. of commercial ammonium hydroxide per gallon—in other words, the alkalinity of methyl red corresponds to that amount per gallon, of ammonia—that it gives satisfactory results. On the other hand, in barrel plating from that same solution, the alkalinity should be greater, and if once determined that for the most satisfactory degree of acidity in barrel plating that the alkalinity should be about 6 c.c. of concentrated ammonia when titrated with methyl red, that would be the value used in maintaining that solution.

Now to illustrate a little further, suppose you wanted to put this method into control. You would first take your solution and adjust it empirically by the addition of acid or alkali until you get it to be what you would consider to be the best value of acidity so that you are getting satisfactory work. That corresponds to the operating pH you normally use. You can measure it on the colori-

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Now to illustrate a little further, suppose you wanted to put this method into control. You would first take your solution and adjust it empirically by the addition of acid or alkali until you get it to be what you would consider to be the best value of acidity so that you are getting satisfactory work. That corresponds to the operating pH you normally use. You can measure it on the colori-

metric set if you want to determine it. Having once done that, then titrate your solution as described in the Metal Industry by Mr. Sizelove, in about 1922, and in a recent article this month—then titrate it with methyl red and standard acid and determine what its alkalinity to methyl red is, in terms of c.c.'s of commercial ammonium hydroxide per gallon of solution. If that corresponds to 6 c.c.'s, as it would in the solution I referred to for barrel plating, that solution is satisfactory, and it tells you that that is the alkalinity you want to control or the value of alkalinity which you wanted to control.

Now suppose your solution goes off. It becomes too alkaline. When you titrate it to methyl red again you will probably have 8 c.c.'s of ammonia per gallon, indicated by the titration. It means that you have to add a certain amount of acid to bring it back to a value corresponding to 6 which is the one that you want to control. Now it has also been shown by Mr. Sizelove that commercial sulpheric acid, CP, one c.c. of that, is equivalent to 2½ c.c.'s of commercial ammonium hydroxide, so that if you want to reduce the alkalinity of your solution about 2½ c.c.'s of ammonia, you can add one c.c. of CP, concentrated sulphuric acid, to a gallon and that will make the correct neutralization.

Now I just want to point out that while the titration method originally was not generally adopted because of the fact that as platers we didn't know as much about analysis as we now know, I can't help but emphasize too strongly that here is a method which now with your knowledge of analysis which you have gained and which a number of you are using, it is entirely possible to control your solution entirely by a titration method with acid as an indicator, and at the same time, when you are doing that, you are determining not only what the pH of your solution is within the satisfactory operating limits—you do that simultaneously—but you are determining the amount of acid or alkali which you have to have in order to correct the solution to that proper pH value. (Applause.)

CHAIRMAN LUKENS: Is there any discussion? Are there any questions? It is certainly gratifying to find that so few of you have problems in determining the H Ion concentrations of nickel solutions. I hope my assumption is correct.

MR. JOSEPH MUIR: Taking the pH reading of a nickel solution, if you get a color reaction there that doesn't correspond

to any of the tubes on your scale from 5.2 to 5.8, what would be the cause of that? Contamination of the nickel solution?

DR. GRAHAM: I presume you are referring to the brome cresol purple. If it is beyond the purple, it is more alkaline and would not be covered by the scale, but you would know it is too alkaline. On the other hand, if it is below 5.2, it is more yellow than the lowest tube you have, and you know it is more acidy. So the thing to do would be to make an addition of either acid or alkali to bring it within the range, and then you would know how much to adjust.

MR. MUIR: This was a deep blue reaction. I imagine it was some contamination.

DR. GRAHAM: If it was a deep blue, it was too alkaline, way beyond the value indicated by the 5.8 tube.

MR. MUIR: I attempted to adjust the solution but it didn't make any change in the plating.

DR. GRAHAM: Ordinarily it would be due to that alone. If you took a small portion of that in a beaker, and added a lot of acid, you should be able to throw it way over on the yellow side.

MR. MUIR: I made it, and brought it back to 5.8. Ordinarily you would think you would get satisfactory results, but I didn't find the same conditions. It gave me dark streaks on the plating, so perhaps there is contamination there.

DR. GRAHAM: Dark streaks can be caused by other things. Ordinarily, the dark streaks you get from the hydrogen concentration are due to two things. Sometimes when the solution is too acidy you might get streaks, but usually they are bright. But if you have too much current with it, it could look like a dark deposit. But if your solution is too alkaline, way above the 5.8 tube, it gives you a dark nickel. So that that would give you generally a dark chrome over it and on the edges there might be a little burned deposit. However, you can have zinc and cadmium in solution as impurities, and they will give you dark streaks.

MR. MUIR: How about copper?

DR. GRAHAM: Copper will give you a bluish nickel before it will give you dark streaks. Zinc and cadmium are more likely.

MR. KEMP: In testing the plating of nickel, would it be

out of the ordinary to take distilled water, boiling, and place the work in there a half hour, and leave it in the same water for six hours afterwards? Should that affect the nickel? We have tried that and found our work was pitted. Now what is the cause of that? It was buffed and nickel plated.

DR. GRAHAM: I am not certain that I got your explanation correctly, but I understand that you are taking the nickel plated article and putting it in distilled water, boiling it and holding it there a half hour, and you get some sort of spots.

MR. KEMP: No. We leave it cool off in the same water six hours, take it out, and there are different spots in there.

DR. GRAHAM: Are you sure you have plenty of nickel on there?

MR. KEMP: That is the question. We have stripped the nickel and found it very good.

DR. GRAHAM: How much did you have on?

MR. KEMP: I haven't that with me. We deposited nickel on there from an hour and a half to two hours, very good nickel. We had other articles in the same tank that withstood all the tests they could put to it, but these things are instruments that won't stand the test as far as that is concerned.

DR. GRAHAM: I am afraid I can't answer the question.

MR. GEBERT: Mr. Chairman, I might say that in our work on getting up methods, somebody quite a few years brought up a point that if you spray distilled water instead of salt solution in your spray, it will work almost as fast. We didn't find it so. The distilled water took a considerably longer time than 20% salt solution. We found even with distilled water the spots would come up if they were through to the steel, and it would have been shown up with the ferricyanide test. It would have shown up. In other words, pits through to the steel would gradually rust the same as they would in the salt solution, and I wondered if you didn't have pits there, and this helped to show them up.

MR. KEMP: We cleaned it off, and there is nickel right there, no marks or anything else after it is cleaned off. That is what gets me.

MR. GEBERT: A pinhole is not visible to the eye.

MR. ROBINSON: With a piece of cadmium plated work, in a solution with a pH point of 5.6, is there any danger of that piece of work being attacked by the free acid in the nickel solution?

DR. GRAHAM: Cadmium, I think, would have sufficient solution pressure so that it would displace nickel just by immersion. Now the thing is, when you start to plate cadmium in a nickel bath, if you don't turn the current on, practically at the same time you put the article in the tank, or you don't make the contact for that length of time it is depositing nickel by immersion, and for all the nickel deposited by immersion, an equivalent amount of cadmium will go into solution. Now that identical condition exists in the plating of die castings, where you have a high zinc base metal, and just the short time that it takes for the article to cover with nickel is sufficient so that a small amount of nickel is deposited by immersion and an equivalent quantity of zinc will go into solution. Now, over a period of time, such nickel solutions build up in zinc to such an extent that they have to be discarded because they would be detrimental. I imagine the same thing would be true with cadmium.

MR. HOFF: Might I mention in connection with that question that the depositing of nickel on cadmium is being carried out as a commercial operation at the present time right here in Philadelphia at the Atwater Kent Company, and some of the representatives from there can tell you of their success?

DR. GRAHAM: Mr. Robinson is from Atwater Kent.

MR. HOFF: Not evading the question, but in addition to that I think we will agree that the chromic acid is more active on cadmium than is nickel, and at the present time chromium coatings are being deposited on cadmium without destroying the luster.

MR. ROBINSON: Is that deposition by immersion detrimental to the nickel after it has made contact in the tank, that is, after the work has made contact in the tank?

DR. GRAHAM: I would say in ordinary operation, where you have the batch of work cleaned, rinsed and put in the solution, and it makes contact the minute the hook strikes the cathode rod, that if the current conditions are properly adjusted on your tank, that no injury would occur. However, if that is allowed to remain in the bank for any length of time with the current off, then you would expect the deposit to be spoiled.

CHAIRMAN LUKENS: Dr. Graham, I extend our thanks to you and I am sure those who see fit to try your suggestions will be well rewarded. Personally, I am quite in accord with favoring such a method of control.

CHEMISTRY AND ELECTRO-PLATING

A. A. Bissiri, B. S., M. A.

Read at First Annual Meeting Los Angeles Branch
March 15, 1930

I feel quite at home in this gathering because many of you are enrolled in my chemistry class, and also because after all you also are chemists, though only practical chemists.

Having listened to the splendid address of your founder, Mr. Proctor, I think there is very little else I can say to show the relation of modern chemistry to your business. Therefore, I will limit myself to give you very briefly my impression of what I consider is the present need of the electroplating industry in Los Angeles.

As was suggested by Mr. Proctor, electroplaters must establish certain standards for their products, which will make possible a guaranteed uniformity of the finished product. And this will be accomplished only when electroplaters will work hand in hand with the chemists.

Other large industries, such as the rubber industry, the steel industry, the paper industry, and many others, have long been placed under strict chemical control, and as a result it has been possible for them to progress very rapidly and to eliminate from their process the element of guess work.

Unfortunately the same can not be said of the electroplating industry.

Judging from the few electroplating establishments I have been privileged to visit, many are still using the unscientific method of "rule-of-thumb."

Certain standard formulas are used and so long as nothing unusual takes place everything is fine; but once in a while things begin to go wrong and then an attempt is made to correct such condition by adding a handful of this or a handful of that.

This perhaps is not true of all the electroplating establishments but is no doubt true of most of the local ones at least.

This should be remedied by the help of the chemist, and since the great majority of electroplaters could not afford the expense of hiring a chemist, and could use him only part time, the solution can be found in the establishment of a co-operative laboratory.

The expense of such a co-operative laboratory could be divided among the different electroplaters according to the amount of work done for each one. And this laboratory should include in addition to one or more analytical chemists, a consulting chemist who could devote some time to the careful inspection of the different plants for the purpose of solving any problem of a chemical nature.

Such a consulting chemist would also keep the local electroplaters well informed of all the latest discoveries in the field of electroplating.

You may not now be convinced of the real need of a co-operative laboratory but there is no doubt in my mind that it will, nevertheless, become a reality within the next few years.

I thank you.

A PANORAMIC VIEW OF THE PLATING SITUATION

Read at Chicago Branch Annual Meeting, Jan. 18, 1930

Jacob M. Hay

Gentlemen: It is doubtful whether all of you present here will immediately grasp the true interpretation of the above title, which of course is rather broad. All of you, I am sure, have realized the change which the plating industry has undergone the past few years.

Since the advent of chrome plate finish, now adopted by practically all of the automotive concerns, which consume tons of the basic material yearly, namely, chromic acid for the plating baths, much interest has been awakened as to the condition leading to the ultimate finish.

We hear and read a good deal on the special or trick methods of polishing and buffing, metal cleaning, with or without current, nickel and copper plating, some favoring cyanide copper bath and others acid copper bath, the P. H. so and so in the nickel bath and metal ion concentration, not saying anything about temperature, current, densities, and other bath ingredients which affect the conductivity of the plating bath and anode material used. At times the writer is inclined to assume that much of this information has put an air of mystery into the art which at times places the plating industry in an unhealthful position. What the buyer or the engineer wants is concrete facts. He cannot waste

his time and money in anything that does not offer some degree of guarantee after he places the finished part on his product.

Now let us stop briefly and analyze the situation as to the real cause for the great interest that has been manifested in other metal finishes which have been considered with some seriousness by the automotive trade. The metal to which I am referring is stainless steel of the straight chrome and chrome-nickel iron series. The latter is being sold under the trade name KA 2. Many of you are either directly or indirectly engaged in the plating industry and I am positive in making the assertion that you no doubt are aware of some of the facts which were directly responsible for the interest displayed in this metal.

If you are on the service end of your personnel whose responsibilities would bring you in contact with the claims that are made on defective chrome plated parts from the field, you would immediately conclude that chrome plate finishes are far from being nontarnishable and rustproof, the former resulting in most cases on brass parts from insufficient coating of nickel and porosity of the plate, and the latter condition is due to nothing else but porous coatings of nickel and copper.

If we are to guarantee ourselves against a great number of these claims which have been emanating from service we must get together and standardize the plating conditions under which the ultimate finish is obtained. I want to emphasize with great stress at this point that in order to overcome the unfavorable reports regarding the life of chrome plate finishes we will have to use good salesmanship in convincing the buyer and public of chrome finished parts that a good commercial grade of plating cannot be done on a cut throat price basis, whether the goods in question happen to be a suit marked at $100 or one at $25 the consumer is getting just what he is paying for. This example may be applied to the metal finishing trade. It is the writer's opinion that if the jobbing plater were to charge a legitimate price for his goods, a reasonable profit could be made that would permit him in conducting a research laboratory on a small scale whereby he could build up for himself a prestige and guarantee a product as coming up to standard specifications after the goods leave his plant.

All of this may sound like fiction to you, gentlemen, but let me issue this warning: some day in the near future you will find many of the now chrome plated parts being changed over to stainless

steels of one of the two types mentioned before. Much of this is being done at the present time. Many of you will say that due to drawing and polishing difficulties the use of stainless steel will be limited. To this can be said with authority that drawing dies are being revamped to take care of any stretcher strains, or breaks which have heretofore taken place in fabricating, and automatic polishing and buffing machines have corrected these faulty conditions in numerous instances.

Many of the failures on chrome plated parts that have been submitted for your attention were due to two major factors. The first resulting from poor adhesion of the plated material to the base metal. This has been corrected by making a careful study in the cleaning and plating operations, especially in the cleaning. There has been a marked percentage drop in the failures of plated parts due to these particular items. The second factor which has not been eliminated and that is causing us some concern is that which is due to the porosity of the successive coats of copper nickel and chrome.

Let us analyze briefly the causes for corrosion of ferrous metals in the unplated state. According to the acid theory carbonic acid contributes a great deal of corrosion. The action which takes place may be expressed by the following equation:

$$2\ Fe + H_2C\ O_3 = 2\ FeCO_3 + H_2$$
$$4\ FeCO_3 + 10\ H_2O + O_2 = 4\ Fe(OH)_3 + 4\ H_2C\ O_3$$

It will be noted from the above equation that iron unites with the carbonic acid forming a ferrous salt, mainly $FeCO_3$ with hydrogen liberated which in turn combines with any dissolved oxygen yielding water. This is followed by the oxygen of the air combining with the soluble iron salt to form hydrated oxide or rust setting free carbon dioxide which is available in making another charge in accordance with the above equation. This action as has been stated before takes place on unplated parts. On plated parts we also have the electro-galvanic theory which most of you are acquainted with. So with these two theories in mind you can readily perceive the necessity of producing a non-porous plate. We cannot combat this corrosion problem if we are to continue placing on the market pitted and porous plated parts.

A few days ago the writer noted an article in one of the daily newspapers illustrating the new method of removing snow and ice

from the streets of one of the large cities in the east. Pellets of calcium chloride were being shovelled on the snow where it is claimed that in a short time a brine is formed which melts the snow, making a slush, facilitating the removal of the same. Do you realize what effect this is going to have on plated parts of an automobile in a few weeks' time? All the more reason why the commercial plating of that part should be free from porosity. These are the elements which we must combat and there are no two ways about it.

These facts presented here, gentlemen, are worthy of some consideration and the sooner we get down to work and improve the quality of the plated finish or parts which have caused any amount of grief the past two years, the quicker you will re-establish confidence in the eyes of both the public and trade as to the much advertised merits of chrome plating, and at the same time meet price competition with some of the newer metals mentioned in the foregoing paragraph. I am sure that the question is important enough for everyone engaged in the art of electro-plating in making a mental inventory of just what is wrong in his department. If it is better basic material that you need for finishing I am sure you can convince your purchasing department in spending a cent or two more per pound, instead of using an inferior grade of basic metal and then eventually realize a tremendous loss due to rejection from your prospective buyer of that part.

As we follow the writers of articles pertaining to nickel and chromium plating, I can not help but feel that there must be something radically wrong with the methods of doing our work and controlling our solutions if these writers making positive statements are right. No one has yet made an attempt to lay down a definite law or has been able to explain to the satisfaction of all concerned the reasons why certain failures occur in the process of preparing and plating metallic parts for nickel and chromium finish.

The writer of this paper will attempt to explain some of the facts as they exist at the present time. I realize that as time goes on we progress and learn things that were unknown before, and we would not be worthy to belong to this great educational society of ours if the new facts were not brought to light.

One of the first important steps we have to consider is the cleaning of metals for plating; so let us begin with the cleaning solu-

tions. Most cleaners are made up of more or less of the same chemicals as hydrates, oxides, phosphates, aluminum carbonate; silicates, colloidal hydroxides, and in powdered form such as clay, ground glass, and powdered sodium silicates.

As these compounds are supposed to have a scrubbing action on the metal surface to be cleaned, mechanically mixed cleaners should not be used for they will separate and will not stay mixed in the solution as they were intended to be. While it is true that finely divided solid particles in suspension assist cleaning yet the clays used for the purpose contain alumina which is sufficiently soluble in the caustic soda to form a soluble aluminate or colloidal hydroxide which can be electrically deposited upon the work causing serious roughness. A fused cleaner of soda ash, tri-sodium, phosphate, sodium silicate rosenate and very little caustic soda will always make a very good cleaner where electric cleaning is done. So much for that. Now let us consider conditions as they exist in every day practice.

Metals are usually drawn in the press room by punch presses or machined upon screw machines or otherwise, the compounds and oils used in these operations are not soluble in the ordinary electric cleaner. Metals of the non-ferrous parts should always be washed in a washing machine with caustic soda and cyanide as this cleaner will be the most effective for washing machines. Steel and cast iron should first be washed and then pickled, then put into an alkaline rinse and then in hot water. After polishing, buffing, and coloring, the parts should then be ready for the electro-cleaning.

Care must be taken that the polishing and buffing composition does not contain more than five per cent of organic greases. One year ago the writer recommended buffing composition without any organic greases, but has found since then that five per cent of petrolatum does not retard cleaning; it is therefore beneficial and helps in the buffing operations as the life of buffs will be longer and the saving in tripoli is quite considerable and the tripoli will also cut faster.

Hot alkaline cleaners are most always operated with an electric current, particularly in automatic machines where the improved cleaning thereby attained is most essential in the absence of brushing and swabbing. The work should always be made the cathode as this causes less passivity than if it were made the anode. Due

to the fact that under certain conditions metals or colloids in the cleaner may be deposited upon the work a short reverse electric cleaning action is introduced to assist in removing this film or stain. This must be done in a separate solution or it will be redeposited as a metal film while the direct current is being applied.

How many of us realized the importance of temperature control in electric cleaning solutions, and yet a fused cleaner made up of the aforesaid composition should be operated at 200 degrees Fahrenheit, in order to give uniform cleaning action and long life. We all know that the alkalinity of any cleaning solution is less active at 150 degrees Fahrenheit than it would be at 200 degrees Fahrenheit. Then if the cleaner in which the parts are to be cleaned is made the anode the temperature of this solution should be kept at 150 degrees Fahrenheit.

Usually in this type of cleaner only soda ash is used, and as soda ash contains a certain amount of iron oxide if an excess amount of heat is used in the soda ash cleaner, the iron oxide will be kept too much in suspension and therefore will settle on parts to be cleaned and a rough nickel deposit will be the result. One other item of importance that has to be considered is that if too high a temperature is used in this type of cleaner the action of the cleaner will be too rapid and will roughen the metallic surface.

Let us consider the water rinses and dips that should be used before entering the cleaned brass metal parts in the nickel solution:

1—Cleaner direct current
2—Cleaner reverse current
3—Water rinse
4—Cyanide dip
5—Water rinse
6—Acid dip 20 per cent hydrofluoric acid
7—Water rinse
8—Nickel solution

If steel or brass soldered parts are to be cleaned the following method should be followed:

1—Cleaner direct current
2—Cleaner reverse current
3—Water rinse
4—Cyanide dip
5—Water rinse

6—Acid dip
7—Water rinse
8—Copper strike
9—Water rinse
10—Acid dip
11—Water rinse
12—Nickel solution

In preparing zinc die castings for nikel and chromium plating one must be sure to get a casting that will finish to a very good non-porous surface as it is almost impossible to chromium plate zinc die castings that have a rough surface or one that is full of pin holes.

Method of cleaning for die castings:

1—Cleaner direct current

2—Water rinse

3—Acid dip 20 per cent hydrofluric acid

4—Nickel solution direct without water rinse

Each and every one of the different metals has its own problem and must be studied as such. Cleaning nickel before chromium plating the following method should be followed in order to do perfect cleaning on nickel plated parts:

1—Electric cleaner made up of 4 oz. cyanide, 2 oz. caustic soda, temperature 200 degrees Fahrenheit—cleaning time 30 seconds

2—Water rinse

3—Electric cleaner—any cleaner that does not contain any soaps will do—temperature 150 degrees Fahrenheit

4—Acid dip hydrochloric acid 8 Beaume on hydrometer

5—Water rinse

6—Cyanide dip—14 Beaume on the hydrometer

7—Water spray

8—Chromium bath

(Show slides at this point and explain details.)

Slides on chromium—

No. 1—

No. 2—

No. 3—

No. 4—

CHROMIUM TANK NO. 1

Date	Content of H_2SO_4	Density of $Cr O_3$	Oz. per gal. of $Cr O_3$	Ratio of $Cr O_3$ to H_2SO_4
Sept. 14	.30	24.17	38.06	126
Sept. 21	.32	23.15	36.04	112
Sept. 29	.31	23.15	36.04	116
Nov. 6	.33	23.15	36.04	109
Nov. 13	.30	23.15	36.04	126
Nov. 20	.28	23.15	36.04	128
Nov. 27	.34	26.15	42.03	123
Dec. 4	.24	23.15	36.04	150

Tank No. 1 would give a very good chromium deposit from ratio 112 to 130; above 130 it would plate cloudy and rough; below 110 it has no throwing power.

CHROMIUM TANK NO. 2

Date	Content of H_2SO_4	Density of $Cr O_3$	Oz. per gal. of $Cr O_3$	Ratio of $Cr O_3$ to H_2SO_4
Sept. 14	.24	23.15	36.4	150
Sept. 21	.32	23.15	36.4	113
Sept. 29	.31	23.15	36.4	117
Nov. 6	.33	24.17	38.6	116
Nov. 13	.34	26.15	42.3	124
Nov. 20	.32	26.15	42.3	132
Nov. 27	.42	25.17	40.3	95
Dec. 4	.32	25.17	40.3	125

Head Lamp Bodies.

CHROMIUM TANK NO. 3

Date	Content of H_2SO_4	Density of $Cr O_3$	Oz. per gal. of $Cr O_3$	Ratio of $Cr O_3$ to H_2SO_4
Sept. 14	.30	22.12	34.4	113
Sept. 21	.32	22.12	34.4	107
Sept. 29	.29	22.12	34.4	118
Nov. 6	.26	24.17	38.6	147
Nov. 13	.31	24.17	38.6	124
Nov. 20	.30	22.12	34.4	114
Nov. 27	.30	22.12	34.4	114
Dec. 4	.30	22.12	34.4	114

Small Side Lamps.

CHROMIUM TANK NO. 4

Date	Content of H_2SO_4	Density of $Cr O_3$	Oz. per gal. of $Cr O_3$	Ratio of $Cr O_3$ to H_2SO_4
Sept. 14	.41	24.17	38.6	94
Sept. 21	.40	23.15	36.4	91
Sept. 29	.47	23.15	36.4	77
Nov. 6	.46	25.17	40.3	87
Nov. 13	.62	27.11	44.2	71
Nov. 20	.52	25.17	40.3	77
Nov. 27	.52	25.17	40.3	77
Dec. 4	.47	23.15	36.4	77

H_2SO_4 is kept very high as we plate parts in this solution that we cannot clean.

12 volts are used for this solution.

The reason for going through this cycle of cleaning and dip methods by us can be explained in the following way. Some of you might remember the paper read by Dr. Graham at the Detroit convention, entitled "Industrial Cleaning of Metals." In his paper he tells of a bonding solution and he states that he believes it necessary to bright dip or etch metals for good adherent deposits. I disagree with Dr. Graham and feel that he either has not had practical experience or has not given this matter of bonding enough thought to be able to give a good reason for his statement.

Bright dips, cyanide dips, or acid dips are only used for removing scale, dirt, grease, and oxides which are formed through either the manufacturing of the metals or in the cleaning process, and if it were not for this scale and oxide that has to be removed after the cleaning operations are done it would not be necessary to use an acid dip in order to get a good adherent deposit. Then is it not reasonable to believe that if you can clean metal parts without tarnish and you can neutralize the cleaning solution in water well enough before entering the nickel solution, the cyanide and acid dip could be eliminated entirely. So let us go back a minute to the cycle of nickel cleaning before chromium plating. One will probably ask, "Why all the cleaning and all the dips?" We'll get to the point at once and explain. In cleaning brass parts nickel plated for cromium plating the first cleaner mentioned which consists of caustic soda and cyanide actually does the cleaning, but the film and the oxide left on the nickel surface from this cleaner can not be removed with acid and cyanide dips. For this reason the second cleaner must be used to remove this hydrogen film. Then the acid dip is used to remove the oxide. The acid dip is followed by the cyanide dip to neutralize the acid and water to rinse the cyanide.

As cyanide has no effect on a chromium solution if only a small amount of the same is carried into the chromium solution, no further rinses are necessary. See next page before going ahead.

The first two slides that I will show here represent two solutions newly made up, and these solutions are made up according to Mr. Loevering's (magic fluid?).

The first slide, as you will notice, shows you that in this solution we have mond nickel anodes of the nickel oxide type.

Slide No. 1—

Here let me again offer some criticism or suggestion if you

CHROMIUM TANK NO. 1

Date	Content of H_2SO_4	Density of CrO_3	Oz. per gal. of CrO_3	Ratio of CrO_3 to H_2SO_4
Sept. 14	.30	24.17	38.06	126
Sept. 21	.32	23.15	36.04	112
Sept. 29	.31	23.15	36.04	116
Nov. 6	.33	23.15	36.04	109
Nov. 13	.30	23.15	36.04	126
Nov. 20	.28	23.15	36.04	128
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Sept. 14	.24	23.15	36.4	150
Sept. 21	.32	23.15	36.4	113
Sept. 29	.31	23.15	36.4	117
Nov. 6	.33	24.17	38.6	116
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Nov. 27	.42	25.17	40.3	95
Dec. 4	.32	25.17	40.3	125

Head Lamp Bodies.

CHROMIUM TANK NO. 3

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Nov. 20	.30	22.12	34.4	114
Nov. 27	.30	22.12	34.4	114
Dec. 4	.30	22.12	34.4	114

Small Side Lamps.

CHROMIUM TANK NO. 4

Date	Content of H_2SO_4	Density of CrO_3	Oz. per gal. of CrO_3	Ratio of CrO_3 to H_2SO_4
Sept. 14	.41	24.17	38.6	94
Sept. 21	.40	23.15	36.4	91
Sept. 29	.47	23.15	36.4	77
Nov. 6	.46	25.17	40.3	87
Nov. 13	.62	27.11	44.2	71
Nov. 20	.52	25.17	40.3	77
Nov. 27	.52	25.17	40.3	77
Dec. 4	.47	23.15	36.4	77

H_2SO_4 is kept very high as we plate parts in this solution that we cannot clean.

12 volts are used for this solution.

The reason for going through this cycle of cleaning and dip methods by us can be explained in the following way. Some of you might remember the paper read by Dr. Graham at the Detroit convention, entitled "Industrial Cleaning of Metals." In his paper he tells of a bonding solution and he states that he believes it necessary to bright dip or etch metals for good adherent deposits. I disagree with Dr. Graham and feel that he either has not had practical experience or has not given this matter of bonding enough thought to be able to give a good reason for his statement.

Bright dips, cyanide dips, or acid dips are only used for removing scale, dirt, grease, and oxides which are formed through either the manufacturing of the metals or in the cleaning process, and if it were not for this scale and oxide that has to be removed after the cleaning operations are done it would not be necessary to use an acid dip in order to get a good adherent deposit. Then is it not reasonable to believe that if you can clean metal parts without tarnish and you can neutralize the cleaning solution in water well enough before entering the nickel solution, the cyanide and acid dip could be eliminated entirely. So let us go back a minute to the cycle of nickel cleaning before chromium plating. One will probably ask, "Why all the cleaning and all the dips?" We'll get to the point at once and explain. In cleaning brass parts nickel plated for cromium plating the first cleaner mentioned which consists of caustic soda and cyanide actually does the cleaning, but the film and the oxide left on the nickel surface from this cleaner can not be removed with acid and cyanide dips. For this reason the second cleaner must be used to remove this hydrogen film. Then the acid dip is used to remove the oxide. The acid dip is followed by the cyanide dip to neutralize the acid and water to rinse the cyanide.

As cyanide has no effect on a chromium solution if only a small amount of the same is carried into the chromium solution, no further rinses are necessary. See next page before going ahead.

The first two slides that I will show here represent two solutions newly made up, and these solutions are made up according to Mr. Loevering's (magic fluid?).

The first slide, as you will notice, shows you that in this solution we have mond nickel anodes of the nickel oxide type.

Slide No. 1—

Here let me again offer some criticism or suggestion if you

would rather have it that way. And in doing so, let me quote Mr. Hogaboom's own words:

"Mr. Reinhardt spoke of Dr. Evans' work. Personally, I think that every plater in this room ought to read Dr. Evans' paper. I think it is one of the most interesting papers that I have had the pleasure of reading in a long time, and to my mind it explained some of the difficulties that have been experienced with cold rolled steel. You, that have plated cold rolled steel, know that you have had some that would plate beautifully. Others, cleaned and handled in identically the same way, would blister or peel. That is mostly true on highly burnished steel. You have pickled it and found a deposit that you could rub your finger on and called it carbon, stating as I have myself, that they probably put oil on it in the rolling, and then when they came to anneal it that oil is carbonized and therefore that carbonized surface was what caused the trouble. It is my opinion, which must be substantiated by data, that in the rolling of highly burnished stock they use less lubrication, and there is greater friction, due to trying to get the very dense structure and the highly burnished top. That friction causes oxidation. I have taken Dr. Evans' one twentieth molar nitrate of copper and put it on a little burnished stock and it has taken two hours before I would get a precipitation of copper, and during those two hours adding a glass rod of fresh solution directly upon the spot. If I were to electrolytic pickle that, and, as Dr. Graham said last night, put hydrogen on so as to reduce that oxide, use cathodic pickling, I could immediately get a copper spot. Collecting a number of samples of cold rolled steel, I got everything from an immediate precipitation of the copper to two hours, according to the stock. So it is my opinion that Dr. Evans has explained a difficulty that has been experienced by platers with rolled steel and it is not a carbonized surface, but an oxidized surface, caused by the friction or the heat of the friction, due to rolling."

Right here we cannot help but see that the film on the steel which Mr. Hogaboom could not dissolve with either acid or cyanide was nothing else but a carbonized or hydrogen film. But as he states himself with an electrolytic pickle he could remove this film of which he speaks.

Mr. Hogaboom accomplished two things with his electrolytic

pickle—the hydrogen gas evolved removed the carbon or hydrogen film and the acid action removed the oxide. On the other hand he could have accomplished the same results without using the electrolytic pickle by going through a cleaning cycle of the same kind as mentioned in the nickel cleaning for chrome plating. So you can easily see that most of our trouble is always with us as most of the platers will not go into details and pay enough attention to facts as he goes along to be able to overcome some of his troubles.

You may notice on Slide No. 1, where we were using the nickel oxide type anode, that we started our solution with a P.H. of 5.4 and maintained the solution at that P.H. for thirteen days. The metallic concentration remained the same. The P.H. changed slightly. Once the P.H. changed to 5.6. Then after adding two gallons of hydrofluric acid the P.H. changed to 5.3 and 5.4. Sodium perporate was added almost daily. The nickel chloride was maintained at 3½ ounces per gallon, which dropped to three ounces per gallon. The nickel deposit was rough and sometimes it was almost impossible to buff the nickel. About the twelfth day we were instructed to chromium plate all parts, and we found at once that the nickel was too hard and that it would invariably peel off the minute we tried to chromium plate the same. Up to this point we did not check for boric acid.

It became evident at once that we had to change our P.H. in this solution. So we added four pounds of sodium carbonate and eight pounds of sodium perporate and then, by adding perporate every day, we finally brought our P.H. up to 5.8. At this point it was noticed that the metal concentration dropped one-half ounce per gallon. We then added 800 pounds of single nickel salt, which brought our metal concentration to 6½ ounces per gallon. Our nickel chloride by this time went down to 2⅜ ounces per gallon and the boric acid to three ounces per gallon. After examining our nickel anodes, we found that they were black and sponge-like. We decided not to add any nickel chloride at this time. We removed the anodes and cleaned them thoroughly, and then made bags from cheese cloth and put the anodes in the bags, figuring that we would be able to overcome the rough nickel deposit. As we had decided the nickel anodes were to blame for our trouble, the anodes by this time were a terrible looking sight.

4000 GAL. SOLUTION

MOND NICKEL ANODE

Metal Contents	Acid Concentration	Nickel Sulphate Added	Nickel Chloride Added	Boric Acid Added	Sodium Sulphate Added	Hydro Fluoric Acid Added	Sodium Perporate Added	Nickel Chloride Concentration	Date
Oz.		Lbs.	Lbs.	Lbs.	Gals.	Gals.	Lbs.	Oz.	
6	5.4	...	...	...	..	..	..	3	6/1
6	5.4	...	...	...	..	..	..	3	6/2
6	5.4	...	...	...	..	..	..	3	6/3
6	5.4	...	...	...	..	..	5	3	6/4
6	5.4	...	...	...	..	..	..	3	6/5
6	5.4	...	...	...	..	..	3	3	6/6
6	5.4	...	...	...	..	..	5	3	6/7
6	5.6	...	...	...	..	1	5	3	6/8
6	5.3	...	...	...	..	1	5	3	6/9
6	5.3	...	...	...	..	..	5	3	6/10
6	5.3	...	...	...	..	..	5	3	6/11
6	5.4	...	...	...	..	..	3	3	6/12
6	5.4	...	...	...	..	..	..	3	6/13
6	5.6	Four Lbs. or Soda Ash			..	..	8	3	6/14
6	5.6	were added here.			..	..	5	3	6/15
6	5.7	...	...	...	..	..	5	3	6/16
6	5.7	...	...	...	..	..	3	3	6/17
6	5.7	...	...	...	..	..	5	3	6/18
6	5.8	...	...	...	..	..	5	3	6/20
6	5.8	...	...	...	..	1	5	3	6/21
6	5.7	...	...	...	..	..	3	3	6/22
5	5.7	800	...	...	..	1	5	3	6/23
6	5.7	...	...	...	..	..	5	3	6/25
6	5.7	...	...	...	..	..	5	3	6/26
6	5.8	...	...	...	..	..	3	2⅞	6/27
6	5.8	...	...	...	..	..	3	2⅞	6/28
6	5.8	...	...	...	..	1	5	2⅞	6/29
6	5.6	...	...	...	..	..	5	2⅞	6/30
6	5.6	...	...	...	..	..	5	2⅞	7/1
6	5.9	...	...	...	..	1	5	2⅞	7/2
6	6	...	...	...	..	1	3	2⅞	7/3

4000 GAL. SOLUTION
DEPOLARIZED NICKEL ANODE

Metal Contents	Acid Concentration	Nickel Sulphate Added	Nickel Chloride Added	Boric Acid Added	Sodium Sulphate Added	Hydro Fluoric Acid Added	Sodium Perporate Added	Nickel Chloride Concentration	Date
Oz.		Lbs.	Lbs.	Lbs.	Gals.	Gals.	Lbs.	Oz.	
6	5.8	...	...	...	..	..	5	3	6/1
6	5.8	...	...	...	..	..	..	3	6/2
6	5	...	...	...	..	2	..	3	6/3
6	5.8	...	...	...	..	..	..	3	6/4
6	5.9	...	...	...	..	..	..	3	6/5
6	5.9	...	...	...	..	1	5	3	6/6
6	5.8	...	...	...	..	..	5	3	6/7
6	5.9	...	...	...	..	1	3	3	6/8
6	5.7	...	...	...	..	1	5	3	6/9
6	5.7	...	...	...	..	..	5	3	6/10
6	5.7	...	...	...	..	..	5	2⅞	6/11
6	5.6	...	...	...	..	..	3	2⅞	6/12
6	5.8	...	...	...	..	..	..	2⅞	6/13
6	5.8	...	...	...	..	..	..	2⅞	6/14
6	5.8	...	...	...	..	..	3	2⅞	6/15
6	5.9	...	...	...	..	1	5	2⅞	6/16

(Continued on page 35)

A. E. S. ANNUAL CONVENTION

Come to Washington, D. C., Educational Bee and Make a Little Whoopee—But Do Not Forget Your Certificate from Railroad, It Means One-half Fare One Way. Heh, Heh

The Annual Convention of the American Electroplaters' Society is to be held this year at the Mayflower Hotel in Washington, D. C., on June 30, July 1, 2 and 3. Splendid accommodations can be obtained at the hotels at very reasonable rates. As the day following the Convention is a holiday (July 4), it will be convenient to spend the rest of the week in Washington seeing the many sights. This would make a wonderful vacation for the whole family.

BY LAND . . . . .

OR SEA . . . . .

OR AIR . . . . .

We only need 125 certificates when we purchase our ticket to get one-half fare back home. Get one.

Committee.

A. E. S. PAGE

Assembled Expert Scraps With and Without Significance

Don't Kick

If some brother is prospering or getting along a little better than you, let him prosper. Don't grunt and grumble; don't kick. Say a good word for him; look pleased and let it go at that.

If you see your Branch is getting along nicely, feel good about it. Help things along. Shove a little; try to get some of the benefit yourself. Don't stand around like a bump on a log and waste your time feeling sore because some other brother has had the sand to forge ahead and prosper. Do a little hustling yourself, but don't kick. If you can say a good word, say it like a man.

If you are sore and disposed to say something mean, keep your mouth shut. Don't kick.

No man ever raised himself up permanently by kicking someone else down. We are helped when we help our brother. Be ready to give a kind word; give it liberally; it won't cost you a cent, and you may want one yourself some day. You may be rolling in wealth today and raising whiskers tomorrow because you can't raise the price of a shave. So don't kick. You can't afford it. There's nothing in it.

Inflated

Northe: "What's a high pressure salesman?"

Weste: "A high pressure salesman is one who is full of compressed wind, and we have met some fellows in our profession just this way."

Don't Quit

When things go wrong, as they sometimes will,
When the road you're trudging seems all uphill,
When the funds are low and the debts are high
And you want to smile, but you have to sigh,
When care is pressing you down a bit,
Rest if you must, but do not quit.

—*Selected.*

4000 GAL. SOLUTION

DEPOLARIZED NICKEL ANODE

Metl Contents	Acid Concentration	Nickel Sulphate Added	Nickel Chloride Added	Boric Acid Added	Sodium Sulphate Added	Hydro Fluoric Acid Added	Sodium Perporate Added	Nickel Chloride Concentration	Date
Oz.		Lbs.	Lbs.	Lbs.	Gals.	Pts.	Lbs.	Oz.	
6	5.8	...	...	...	..	..	3	2⅞	6/17
6	5.8	...	...	...	..	..	5	2⅞	6/19
6	5.9	...	...	...	..	1	5	2⅞	6/20
6	5.8	...	...	...	..	1	5	2	6/21
6	5.8	...	...	...	..	..	3	2	6/22
6	5.8	400	...	...	..	1	5	2	6/23
6	5.7	...	...	...	..	..	5	2	6/25
6	5.9	...	...	...	..	1	3	2	6/26
6	5.8	...	...	...	..	..	3	2	6/27
6	5.8	...	...	...	..	..	3	2	6/23
6	5.9	...	...	...	..	..	3	2	6/29
6	5.7	...	...	...	..	..	5	2	6/30
6	5.8	...	...	...	..	..	..	2	7/1
6	5.9	...	...	...	..	1	5	2	7/2
6	5.7	...	...	...	..	..	5	2	7/3

4000 GAL. SOLUTION

DEPOLARIZED NICKEL ANODE

Metal Contents	Acid Concentration	Nickel Sulphate Added	Nickel Chloride Added	Boric Acid Added	Sodium Sulphate Added	Hydro Fluoric Acid Added	Sodium Perporate Added	Nickel Chloride Concentration	Date
Oz.		Lbs.	Lbs.	Lbs.	Gals.	Pts.	Lbs.	Oz.	
6	6.1	...	...	...		2	4	5	4/21
6	6.1	...	...	200		2	4	5	4/22
6	6.1	...	...	...		2	4	5	4/23
6	6.1	...	...	...		2	4	5	4/24
6	6.0	...	...	...		2	5	5	4/25
6	6.0	...	...	...		2	5	5	4/26
6	6.0	...	...	...		2	5	5	4/27
6	6.1	...	...	200		2	4	5	4/28
5	6.1	500	...	...		2	4	5	4/29
5	6.1	...	500	...		2	4	5	4/30
6	6.0	...	...	...		2	5	5	5/1
5	6.0	...	...	...		2	5	4½	5/2
5	6.0	500	...	...		2	5	4½	5/3
5	6.0	...	...	...		2	5	4½	5/4
5	6.1	500	500	200		2	5	4½	5/5
6	6.1	...	...	...		2	4	5	5/6
6	6.0	...	...	...		2	5	5	5/7
5	6.0	500	...	...		2	5	5	5/8
5	6.1	...	...	...		2	4	4½	5/9
5	6.1	500	500	...		2	4	4½	5/10
6	6.1	...	...	...		2	4	5	5/11
6	6.0	...	...	200		2	5	5	5/12
6	6.0	...	...	...		2	5	5	5/13
6	6.1	...	...	...		2	4	5	5/14
6	6.1	500	500	100		2	4	4	5/15
6	6.0	...	...	...		2	5	5	5/16
6	6.0	...	...	...		2	5	5	5/17
6	6.0	500	...	...		2	5	5	5/18
6	6.1	...	...	200		2	4	5	5/19
6	6.1	...	...	...		2	4	5	5/20
6	6.1	...	...	...		2	4	5	5/21

2 Gal. Per Month

BORIC ACID CONTENT 4 OZ. PER GAL.

4000 GAL. SOLUTION

MOND NICKEL ANODE

Metal Contents	Acid Concentration	Nickel Sulphate Added	Nickel Chloride Added	Boric Acid Added	Hydro Fluoric Acid Added	Sodium Sulphate Added	Sodium Perporate Added	Nickel Chloride Concentration	Date
Oz.		Lbs.	Lbs.	Lbs.	Gals.	Pts.	Lbs.	Oz.	
5	5.9	...	...	200		2	4	11	11/11
5	5.9	...	...	...		2	4	11	11/12
5	5.9	...	...	...		2	4	11	11/13
5	5.9	...	...	...		2	4	11	11/14
5	5.9	500	...	...		2	4	11	11/15
6	5.9	...	200	200		2	4	8	11/16
6	5.8	...	...	...		2	5	11	11/17
6	5.8	500	500	200		2	5	9	11/18
6	5.7	...	...	...		2	6	11	11/19
6	5.7	...	...	...		2	6	11	11/20
6	5.7	...	...	...		2	6	11	11/21
6	5.8	...	...	...		2	5	11	11/22
6	5.8	...	...	...		2	5	10	11/23
6	5.8	...	...	...		2	5	10	11/24
6	5.9	...	...	...		2	4	10	11/25
5	5.9	...	...	...		2	4	10	11/26
5	5.9	500	...	...		2	4	10	11/27
5	5.9	500	...	...		2	4	10	11/28
5	5.9	...	...	...		2	4	10	11/29
5	5.9	...	...	...		2	4	10	11/30
5	5.9	...	500	200		2	4	10	12/1
6	5.7	...	...	...		2	6	11	12/2
6	5.7	...	...	...		2	6	11	12/3
6	5.7	...	...	...		2	6	11	12/4
6	5.7	...	...	...		2	6	11	12/5
5	5.9	500	...	...		2	4	10	12/6
5	5.9	...	...	...		2	4	10	12/7
5	5.9	500	500	200		2	4	10	12/8
6	5.8	...	...	...		2	5	11	12/10
6	5.8	...	...	...		2	5	11	12/11
6	5.8	...	...	...		2	5	11	.....

? Gal. Per Month

BORIC ACID CONTENT 4 OZ. PER GAL.

We got in touch with the maker of the anodes. After their metalurgist saw the anodes he gave instructions to return the anodes. These anodes were replaced with another type with a higher nickel oxide content. While these anodes were much better than the first ones they were still rough and oxide would form on the anode which required cleaning from time to time; and the nickel deposit would be just as rough as before. I might state here that we were using 30 amperes per square foot and the solution was operated at 120 degrees Fahrenheit. The maker of the anodes now figured that the high amperage caused some of the trouble. Filtering the nickel solution only made matters worse, so we finally decided that some of the trouble must be with us. I began to investigate cleaners, acid and cyanide dips. You can well imagine that the cleaning salesmen began to have some fun. We knew we had no reason to blame them, but we were out to

find the cause of our trouble and we blamed everybody we could think of—even the composition manufacturers got into this.

About this time Mr. Gilchrist, who at that time was with the Ternstad Manufacturing Company, one of the General Motors Divisions, decided that he could not use 99 nickel anode and went back to 95 and 97. I decided that I would not go back to that, so I kept on investigating and fighting every day to overcome rough nickel.

(Show Slide No. 2.)

Slide No. 2 shows the same solution with the depolarized anode oxide sulphuric type. The anode corrosion in this solution was more uniform as far as the upkeep of the metal content of the solution was concerned. Otherwise the anode was rough and did not corrode with a fine grain. The nickel deposit was just as bad as in the other solution. In general conditions prevailed just the same as in the first solution with the nickel oxide type anode. You must remember that hydrofluric acid was used in both of these solutions. This solution plated very rough.

George B. Hogaboom found that the same condition existed in his experiments, and an investigation of nickel solution Slide No. 1 and Slide No. 2 would in itself explain that what George B. Hogaboom found out about anode and cathode efficiency was true. (Anode efficiency—99.8; cathode efficiency—79.8.)

There is one item that Mr. Hogaboom overlooked. This item is: if the nickel deposit could be kept finely grained and free from rough nickel, with a slight modification one could get to the point of a self-sustaining nickel solution which in itself would be an ideal condition. So far I have not discovered how to overcome this condition and at the same time have a fine nickel deposit.

Slide No. 3.

This solution was made up without hydrofluric acid. For a period of over a month, we added 3500 pounds of single nickel salt to keep the metal content uniform, also allowing drag-out of the solution. Two thousand pounds of nickel chloride were added to keep the metal content and the chloride content uniform. Our nickel chloride content was kept around five ounces per gallon. The P.H. of the nickel solution No. 3 was kept constant or nearly so by the addition of hydrochloric acid and sodium perporate. We kept daily check on our solutions. Boric acid was kept at four

4000 GAL. SOLUTION

MOND NICKEL ANODE

Metal Contents	Acid Concentration	Nickel Sulphate Added	Nickel Chloride Added	Boric Acid Added	Hydro Fluoric Acid Added	Sodium Sulphate Added	Sodium Perporate Added	Nickel Chloride Concentration	Date
Oz.		Lbs.	Lbs.	Lbs.	Gals.	Pts.	Lbs.	Oz.	
5	5.9	...	...	200		2	4	11	11/11
5	5.9	...	...	...		2	4	11	11/12
5	5.9	...	...	...		2	4	11	11/13
5	5.9	...	...	...		2	4	11	11/14
5	5.9	500	...	...		2	4	11	11/15
6	5.9	...	200	200		2	4	8	11/16
6	5.8	...	...	...		2	5	11	11/17
6	5.8	500	500	200		2	5	9	11/18
6	5.7	...	...	...		2	6	11	11/19
6	5.7	...	...	...		2	6	11	11/20
6	5.7	...	...	...		2	6	11	11/21
6	5.8	...	...	...		2	5	11	11/22
6	5.8	...	...	...		2	5	10	11/23
6	5.8	...	...	...		2	5	10	11/24
6	5.9	...	...	...		2	4	10	11/25
5	5.9	...	...	...		2	4	10	11/26
5	5.9	500	...	...		2	4	10	11/27
5	5.9	500	...	...		2	4	10	11/28
5	5.9	...	...	...		2	4	10	11/29
5	5.9	...	...	...		2	4	10	11/30
5	5.9	...	500	200	? Gal. Per Month	2	4	10	12/1
6	5.7	...	...	...		2	6	11	12/2
6	5.7	...	...	...		2	6	11	12/3
6	5.7	...	...	...		2	6	11	12/4
6	5.7	...	...	...		2	6	11	12/5
5	5.9	500	...	...		2	4	10	12/6
5	5.9	...	...	...		2	4	10	12/7
5	5.9	500	500	200		2	4	10	12/8
6	5.8	...	...	...		2	5	11	12/10
6	5.8	...	...	...		2	5	11	12/11
6	5.8	...	...	...		2	5	11	.....

BORIC ACID CONTENT 4 OZ. PER GAL.

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(Show Slide No. 2.)

Slide No. 2 shows the same solution with the depolarized anode oxide sulphuric type. The anode corrosion in this solution was more uniform as far as the upkeep of the metal content of the solution was concerned. Otherwise the anode was rough and did not corrode with a fine grain. The nickel deposit was just as bad as in the other solution. In general conditions prevailed just the same as in the first solution with the nickel oxide type anode. You must remember that hydrofluric acid was used in both of these solutions. This solution plated very rough.

George B. Hogaboom found that the same condition existed in his experiments, and an investigation of nickel solution Slide No. 1 and Slide No. 2 would in itself explain that what George B. Hogaboom found out about anode and cathode efficiency was true. (Anode efficiency—99.8; cathode efficiency—79.8.)

There is one item that Mr. Hogaboom overlooked. This item is: if the nickel deposit could be kept finely grained and free from rough nickel, with a slight modification one could get to the point of a self-sustaining nickel solution which in itself would be an ideal condition. So far I have not discovered how to overcome this condition and at the same time have a fine nickel deposit.

Slide No. 3.

This solution was made up without hydrofluric acid. For a period of over a month, we added 3500 pounds of single nickel salt to keep the metal content uniform, also allowing drag-out of the solution. Two thousand pounds of nickel chloride were added to keep the metal content and the chloride content uniform. Our nickel chloride content was kept around five ounces per gallon. The P.H. of the nickel solution No. 3 was kept constant or nearly so by the addition of hydrochloric acid and sodium perporate. We kept daily check on our solutions. Boric acid was kept at four

ounces per gallon. It required 1300 pounds of boric acid per month to keep the boric acid at four ounces per gallon. We added 250 c.c. of hydrofluric acid during the month. The plating in this solution was much better than before, but we could not get away from rough nickel. Although the rough nickel was not as bad as in the other solutions, we still had it with us and it caused a lot of trouble in nickel buffing.

Slide No. 4.

In Slide No. 4 you may notice that we more than doubled our nickel chloride content or in other words we brought it up to 11 ounces per gallon. As we started our solution with more nickel chloride, our metallic nickel content was only 5½ ounces and the P.H. at that time was 5.9. It required 3000 pounds of single nickel salt per month and 2000 pounds of nickel chloride to keep the metal content and the nickel chloride content constant. We had very little trouble controlling P.H. The P.H. was kept constant by two pints of hydrochloric acid and a slight variation of sodium perporate from 4 to 6 pounds per day. We were able to hold the 4 ounces of boric acid by the addition of 2000 pounds of boric acid during the month. In addition to the boric acid we added 250 C.C. of hydrofluric acid daily to control the rough nickel deposit.

The nickel deposit from this solution was the best that we were ever able to obtain from any nickel solution we tried. The nickel coating was very easy to buff and would never peel under any condition.

When one considers that we plated 3960 head lamps in nine hours with an average of three square feet to the lamp, figuring two square feet for the outside surface and allowing fifty per cent for the surface not directly exposed to the anode, and other parts such as side lamps, side lamp doors and head lamp doors—altogether about 21.284 square feet and 7128 square feet of reflector; the amount of nickel salt, nickel chloride and boric acid added during the month were actually carried out in the drag out. I feel that this type of solution shown in Slide 4 is as near perfect as one can get for general production work.

Show slides from 4 to 24 nickel anodes, 24 to 26 porous nickel deposit.

While the hour is getting late, and we have very little time left to go into further details about the plating situation, I do wish

to make a few remarks about pitting. When we talk about pitting we get on dangerous ground at once. We all seem to know so much about pitting that on the face of everything that has been said and written by authors we really ought not to have any more trouble with it. Here are some of the causes of trouble given by certain writers: too high in acid, too low in acid, high current, dilute solution, undissolved air, oxygen organic matter and what not. If we know the real reason for pitting why haven't we eliminated all this trouble? Supposing we have to cut a piece of wood ten inches long to fit in a certain space, we could not very well cut the piece of wood twenty inches long and expect it to fit in the space where ten inches is required. So I believe that with solutions under control and all other conditions under control it is impossible to have pitting.

I thank you.

Slide No. Nickel Anodes

5 Cast 90-92 per cent nickel. 75x.

6 Cast 95-97 per cent nickel.

7 Cast 95-97 per cent nickel.
This illustrates what an anode looks like when there are high impurities.

8 Cast 95-97 per cent nickel.
If an anode is not scrubbed during its life the carbon and iron will hold the original shape of the anode. The nickel will be leached out. Note the core of cast nickel—all outside of the core is carbon and iron.

9 There is no slide.

10 Cast 99 per cent nickel.
Note the structure especially along the outside edges where the solution will attack the grain boundaries. This is better illustrated later on. See slide number 13.

11 Cast 99 per cent nickel.
The spots are nickel oxide. The nickel oxide is very high. The highest it should be is about 1.10 per cent.

12 Cast 99 per cent nickel.
This shows the intergrain boundaries clearly.

13 Cast 99 per cent nickel.
This shows how No. 12 will be attacked in a plating

solution. Note how the intergrain boundaries have been dissolved and some grains of nickel are about to leave the anode before being dissolved in the solution. The anode is disintegrated rather than corroded.

14 Electrolytic nickel.
Starting sheet at the beginning of the deposit.

15 Electrolytic nickel annealed.

16 Electrolytic nickel rolled.
In No. 15 note the spaces between crystals.
In No. 16 it is shown that the crystals are not held together and the metal will fall apart. That accounts for the metallics given off by electrolytic nickel in a plating solution. Contrast this with a rolled anode. See No. 18.

17 Cast nickel rolled—99 per cent.
Note that the grains do not hold together. I rolled at least 12 pieces before I got this one. The slightest increase of pressure during the rolling would cause this piece to break up into a number of small pieces. This is characteristic of cast nickel at present.
Cast nickel must be heat treated and forged before it can be rolled. An ingot 14 inches by 14 inches by 45 inches long is forged with a heavy drop hammer to 3 inches wide by 2 inches thick before it is rolled for anodes. For sheets it is rolled into slabs 8 inches wide by 1½ inches thick.

18 Forged and rolled—99 per cent nickel.
This piece is about .015 inches thick. The dark lines are just light shadows when photographed.

19 Rolled 99 per cent nickel.
Picture of the outside edge of the cross section of an anode.

20 Same as No. 19, except the picture is of the center of the anode. Note the uniformity of the structure throughout the anode.

21 This slide shows you a Mond nickel oxide type anode as used in nickel solution as per slide No. 1 and No. 2.

Slide No. Nickel Anodes

22 Shows you a depolarized nickel anode sulphur oxide type anode as used in solution as per slide No. 1 and No. 2.

23 Shows the Mond nickel anode of somewhat higher oxide than the first anode. This anode was used in solution as per slide No. 4 with 11 ounces of nickel chloride and 4 ounces boric acid.

24 Shows anode depolarized of the sulphur oxide type used in solution No. 4 with 11 ounces nickel chloride.

(Cuts mentioned here will be printed in June issue.)

ST. LOUIS BRANCH

Regular meeting of the St. Louis Branch, A. E. S., was held on Friday, April 11, at Central Y. M. C. A. Dinner was served at 6:15 P. M.

The meeting was called to order by President Reifling.

Minutes of previous meeting were approved.

Communication was read from a man that sent in for application, but who had only one year's experience at plating. The president asked if anyone had any questions and discussion.

He then called on Dr. L. Stout, who gave a very interesting talk on some of the things that he was doing at Washington University in the plating line. It was enjoyed by all present.

Meeting adjourned.

Very truly yours,

C. T. McGINLEY, Secretary.

THIS:

LAST CALL

FOR 1930 ANNUAL MEETING:

GET READY TO ATTEND.

TO THE MEMBERS OF A. E. S.

The time has arrived for my departure as your Editor. I am filled with gratitude to you for the great honor which you conferred upon me, for past four years, the customary length of service in this office.

Although I am truly sensible of the opportunity for service which you placed before me, my chief regret is that I have not been able to carry out and execute all the things we planned to do.

When an organization gets as large as the A. E. S. it becomes difficult to assimilate its members and hence we have to resort to outside means to get acquainted. I believe, therefore, we should encourage the social side of our Society as well as the educational, and I believe our annual banquets do more in breaking down barriers of reticence and reluctance on the part of members, to debate at meetings than all the formal regular meetings could ever do, and should be given every attention by our branch officers and it is my earnest prayer that this practice will be enhanced more each year.

In making my decisions on all matters while in office, I have always endeavored to be impartial and have used the same yardstick in measuring right and wrong and that to my understanding was justice. In reviewing the closing events of my service to you, I feel inclined to offer the well known axiom, God forgive us for the things we left undone and have mercy upon us for the things we ought not to have done. Few of us ever realize all our ambitions. It seems that time moves slow while waiting to receive but how fast it flies when there are things to do and before you apparently start you are through.

Before I close, I am loath to miss the opportunity to thank you one and all and especially those men whom it has been my great pleasure to work with in the endeavor to promote the welfare of

our Society, and I hope that some unselfish devotion to one industry and its progress shall continue until the end and impress upon the members the importance of regular attendance, stimulating interest of the officers.

To my successor and his associates I wish greater success than I had and in conclusion again I thank you most gratefully for the manifold courtesies which have been bestowed upon me.

Sincerely yours,

Frank J. Hanlon.

NEW YORK BRANCH

Mr. Charles H. Proctor, Mrs. Proctor and their oldest son, Harry R., will leave for a European trip on Wednesday midnight, July 9th, on the Cunard Liner "Tuscania." Mr. Proctor and his family go to Europe in search of health and will not return until the fall of the year.

Mr. Proctor states that unless his health improves by the time he returns he will lay aside all his present activities until such time as his health does improve.

LOS ANGELES BRANCH

The regular monthly meeting of the Los Angeles Branch was held as usual the second Wednesday of the month, at the Elite Cafe.

The meeting was called to order by President C. E. Thornton. Thirty-three were present and seven new members were elected.

The minutes of the various meetings were read and approved. All bills voted paid. Communications were read and noted. A letter from Dr. Wm. Blum asking for papers for the convention was read.

The following were elected to office for the coming fiscal year:

C. E. Thornton, re-elected president.

E. W. Francis, vice-president.

M. D. Rynkofs, re-elected secretary-treasurer.

Robert Gripp, librarian.

M. Brooks, C. G. Spence and J. Merrigold, as Board of Managers.

J. Jacques, re-elected sergeant at arms.

J. Merrigold, W. E. Hurd and W. A. Schuler as representatives of the Supreme Society.

The outgoing Librarian, Mr. Chas. A. Russill, then took charge and the following questions were in the box:

Question 1. Is it advisable to plate bumpers or shells in Cadmium previous to Nickel for Chrome plating? Will it be rustproof?

Answer 1. It is not successful.

Question 2. I would like to know what all this talk about "Stainless Steel" and "Rustproof Iron" on automobiles means to the Plater.

Answer 2. See March Review, page 49.

Question 3. After adding single nickel salts until solution shows pH 6.1 and 3 oz. metal content. Solution plates dark in back-ground. Why?

Answer 3. Hang more nickel anodes in tank.

Question 4. I want to plate chrome in a barrel, what must I do?

Answer 4. Platers, please help.

Question 5. How much Zinc sulfate is used per gal. of Chromium solution and what is it used for?

Answer 5. Answer in April Review, page 31.

The meeting adjourned at 11:15 P. M.

M. D. RYNKOFS, Sec'y-Treas.

ST. LOUIS BRANCH

Regular meeting of the St. Louis Branch of A. E. S. was held at the Central Y. M. C. A.

After a good dinner meeting was called to order by President Reifling.

After roll call of officers, minutes of the previous meeting were read and approved.

Two applications were read and turned over to Board of Managers.

The following officers were elected for the coming year:

Al. Reifling, president; R. C. Kells, vice-president; C. T. McGinley, secretary-treasurer. Our old friend and standy-by, H. H. Williams, was elected librarian.

Board of Managers—E. P. Menninges, H. J. Richards, F. N. Weber.

Meeting was then turned over to Dr. Stout who gave a very interesting talk and answered questions.

Meeting adjourned at 9:30 P. M. with fifteen (15) members present.

C. T. McGINLEY, Sec'y-Treas.

LAST CALL

ANNUAL MEETING

JUNE 30, JULY 1, 2, 3, 1930

WASHINGTON, D. C.

PHILADELPHIA BRANCH*

President's Letter

"Well 'Well' the plating world Estening in"

[with apologies to Tom Noonan, Bishop of Chinatown]

Ladies and Gentlemen, this is the Philadelphia Branch, the heart of the "Quaker City Platers Reminder," broadcasting, and along comes another letter, this time from away out in St. Louis, Mo., where they have to be shown. Well I am from that good old state myself and I am proud of it.

The letter comes from the Musick Plating Works and Ed. is the big boy there and among other things he says, I received a copy of the "Reminder" and your branch certainly has the right idea and what a great thing it would be if all the branches would follow the idea and have their paper and discussions printed, and what a grand "Monthly Review" our Society would have, if all branches would have a "Reminder" and the get the same printed in the Review each month.

Well, we think so, too; so you see, some like us and maybe others don't, but we think it's a good thing and with the cooperation of the members and Ye Editor Gehling we are going to continue to broadcast through our branch.

Our last meeting was pretty hot, we don't know what it's all about, but we know that there was plenty doing, acting on applications for membership and nominations of officers and delegates to the convention kept things pretty well crowded and finally we let Geo. Hogaboom do it and he did.

Our old friend George gave us a very interesting talk on Black Nickel which was greatly appreciated.

During the past month our venerable secretary, Philip Uhl, and myself were guests at the luncheon given by the Platers' Class at the Mastbaum Vocational School and if you don't think it was worth while, you're all wet.

There were present besides the members of the class, three members of the Board of Education, Principal Lowery, Mr. Linton and Mr. Binder. They all spoke of the good work that had been accomplished, especially under the tutorship of instructor Al. Hirsch, another product of the Philadelphia Branch.

The luncheon wound up in a general round table talk that was most interesting, so much so, that if there is any possible way, your president is going to be a member of the fall class and I hope to see a lot more of you fellows there.

Newark Branch boasts that 50 per cent of their members attend the

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*Credit Phila. Branch Quaker City Reminder.

platers' class, not one but two nights a week, so let's show them that we are not lacking in progressive ideas, so let's dig some of the acres of diamonds that lie at our own door waiting to be dug up.

The May meeting is to be devoted to "Chrome." Everybody come out and help to make this a big success, let's have an old time experience meeting, bring in your problems and experiences and help the other fellow.

S. T. LUMBECK.

Editor's Notes

It is with regret that we report that Geo. Hogaboom muzzled our branch at the last meeting, and thereby deprived our out of town members the privilege of his talk, but George has his reasons, and as the branch did not want to deprive the members present of the talk the branch acceded to George's request in not having the stenotype reporter take down the talk and the discussion.

At our May meeting there will be a Round Table Talk and discussion on Chrome-Plating and all members are invited to take part in the same. Any out of town members who have discovered any new kinks and care to let the other fellow know about it, are invited to send the same in to the editor, who will read them at the meeting and give credit to the writer for the same.

Some of these things may seem simple and easy to you but may mean a whole lot to some one else, so no matter how easy a thing seems to you write it down and someone will appreciate it. Also there may be some who also know the same but may have forgotten it, and your tip will bring it back to their minds again.

WATERBURY BRANCH

Close on to fifty people were present at the Educational meeting of Waterbury Branch, held Friday evening, May 9th. Included in the gathering were manufacturers, chemists and others interested in the electro-deposition of metals. President Muscio welcomed those present in well chosen words, and called attention to the banquet and educational session of the Hartford-Connecticut Valley Branch, which was to be held the following day, and suggested that all who possibly could, attend.

The speaker of the evening, Mr. John C. Bradley, metallurgist of the American Brass Co., was then introduced, and taking for his subject, "Some Aspects of Crystal Structure as Applied to Metal Finishing," he held his audience deeply interested for nearly two hours. Photographs and samples, along with lantern slides and charts, combined with the speaker's pleasing delivery, helped to make the address

instructive as well as entertaining. At intervals during the talk the speaker displayed some chemical experiments which were of a novel and interesting nature. Mr. Bradley was ably assisted in his work by Ellsworth Condee, a member of the local branch. The questions, answers and discussion that followed were enjoyed by all. President Muscio extended the thanks of all present to the speaker and his assistant for the splendid entertainment. The entertainment committee, consisting of Wm. Gray, Wm. Cavanaugh, Wm. Delage, Gorman Tice and Leroy Miller, provided ample refreshments for all present.

W. F. GUILFOILE, Secretary.

CHICAGO BRANCH

The 218th regular monthly meeting of Chicago Branch, A. E. S., was held Saturday, May 10, 1930, at the Atlantic Hotel. Meeting was called to order with Pres. S. J. C. Trapp presiding, and all officers present.

This was a banner meeting; there were over 80 members present.

The chemistry class has finished its course and it was very successful, thanks to our instructor, Mr. H. Faint, and his able assistants, Mr. C. Kocour and Mr. J. Hoefer.

Dr. Harold K. Work of the Aluminum Co. of America gave a very interesting lecture on "The Electro-Plating of Aluminum." This lecture contained much valuable information and should be a great help to platers who are doing this kind of work.

Our annual election of officers took place and the following were elected unanimously: S. J. C. Trapp, president; J. J. Witte, vice-president; J. C. Kretschmen, secretary-treasurer; O. E. Servis, librarian.

The Board of Managers, consisting of R. J. Hazucha, chairman, Gus Jelinek, and Fred Herbst, were elected by ballot.

David Greenblatt was appointed sergeant-at-arms.

The meeting was then turned over to the librarian, who found the following questions in the box:

Ques. No. 1. Wanted, formula for an alkaline lead sol.

Ans. No. 1. Water, 1 gal.; lead acetate, 2 oz.; caustic soda, 5½ oz.; potassium chlorate, ⅛ oz.; flaxseed, 4 to 6 oz. Boil the above mixture and then strain. Use at a temperature around 140 degrees F. with current density from 2 to 3 volts.

Ques. No. 2. What is the best formula for a white brass sol.?

Ans. No. 2. Any good brass sol. with the addition of arsenic or acetate of lead.

Ques. No. 3. What is Barbardiene Bronze and how is it produced?

Ans. No. 3. Add enough sodium hydroxide to 1 gal. of water to dissolve 4 oz. of antimony oxide and then add a little ammonia.

Ques. No. 4. How can copper be stripped from zinc die casting without injury to brass?

Ans. No. 4. Reverse current, hot cyanide sol.

Ques. No. 5. Is there any dip that will make yellow metal look the same color as red metal?

Ans. No. 5. Pickle in hot muriatic acid, use brass baskets. Add a small amount of copper filings to get dip started.

J. C. KRETSCHMER, Secretary.

DETROIT BRANCH

Detroit Branch held its regular monthly meeting Friday evening, May 2, at the Statler Hotel, President B. F. Lewis presiding.

Minutes of previous meeting approved as read. After regular business the meeting was turned over to Chairman of Educational Committee, who conducted question box, the following being questions and answers submitted.

Respectfully yours,

CHAS. M. PHILLIPS, Secy. and Treas.

Q. How may a greenish color be produced on 60-40 brass castings or forgings by acid dipping?

A. Suggested that the article be bright-dipped in sulphuric and nitric (2:1) directly from an alkali cleaner.

Q. Will sodium sulphate improve the efficiency of a cyanide copper bath?

A. No improvement is experienced in a cyanide cadmium bath, while there is a disadvantage in the solvent effect of the sulphate on steel tanks and anode holders. This might also apply to copper cyanide baths.

Q. What causes lead coils to dissolve in a chrome tank?

A. Reserve answer till June meeting.

Q. What is a sufficient time for saltspray test on plated die castings?

A. Nickel plated—20 hours. Chrome plated—50 hours or more.

Q. What causes milky colored spots in chrome plating?

A. May be due to incomplete neutralization of alkali cleaner, or to the nickel becoming tarnished and passive prior to chrome plating.

Q. What is the best method of drying work coming from a chrome solution?

A. Rinse thoroughly in cold water and dry in moderately hot circulated air.

Q. What is the best stripping solution for chrome and nickel?

A. Strip chrome with reverse current in boiling electric cleaner, and nickel in the usual sulphuric acid electric strip 50 deg. Be.; or strip both in the sulphuric acid strip.

Q. What is a good way to handle aluminum stampings for nickel plating in quantities.

A. Pre-clean in organig solvent, then in special aluminum cleaner (electric), etch in acid dip (hydrofluoric-nitric mixture) then nickel plate as usual. (See Amer. Electrochemical Soc. Bulletin No. 23 (1928)).

Q. What is your experience with the "current density meter"? Which type is preferred, the one hung on the work rod, or the one suspended between work or anode?

A. The preferred type is the one which is immersed without contact with the anode or cathode rod.

Q. Is it likely that some chromium alloy might be used as anode in the chromium plating bath?

A. Such alloys corrode readily and produce trivalent chromium, which is objectionable.

Q. Can .001 inch of nickel be deposited in 10 minutes?

A. It is stated that this can be done by means of high temperature, high current density, and low pH, with extreme agitation.

CLEVELAND BRANCH

The May meeting of Cleveland Branch was attended by more than the usual number and after electing the following officers: President, E. S. Thompson, vice-president, H. J. Terdoest; secretary-treasurer, Paul R. Stamm; librarian, W. D. Scott; board of managers, J. C. Singler, N. E. Jadowski and W. E. O. Berg. We were given a farewell party by our fellow member, Mr. F. G. Cynx of the Hanson Van Winkle Munning Co., who has been transferred from Cleveland to Mattewan, to our sorrow.

Well, Mr. Cynx did himself proud by giving the boys a lunch and plenty of good coffee. A lot of good speeches for his welfare and a lot of good stories for our entertainment, and I thought it a shame how some of whom I supposed were his best friends told one story after another about Cy. and did not give him a chance to come back, as Cy. always has business reasons to interfere with him coming back. Not that he has not the ability to tell a story about any of us.

All Cleveland Branch wishes him well in his new position and look for some very pleasing benefits to the firm that employs him.

H. J. TERDOEST, Secretary.

BRIDGEPORT BRANCH

Meeting was called to order with President George Wagstaff presiding. Roll call was read and all officers were present.

The minutes of the last meeting were read and accepted, and the application of Mr. Walsh was read, accepted and voted on to take the usual course.

It was also voted that the secretary should answer the letters of April 11th and 18th, 1930, received from Baltimore-Washington Branch.

The Banquet Committee's report was accepted and a rising vote of thanks was given to Mr. O'Connor and all who co-operated with him in making the banquet a success. Banquet Committee was then discharged.

Election of officers then took place and the following were elected for the coming year: George Wagstaff, president; William Ehrencrona, vice president; Thomas Chamberlain, secretary and treasurer; Herman Braun, librarian; William Flaherty, sergeant at arms; board of managers: W. Stratton, J. C. Oberender, W. Thompson.

The following members were also elected to the Bridgeport Branch: William J. Peters, Pasquale Pempinella, John Brown, Charles Max Altermatt, Howard G. Rice.

A motion was also made and seconded to hold the 1931 convention at Bridgeport, the Industrial Capital of New England.

Then the treasurer's report was read and accepted, following which a motion was made and seconded that the meeting be closed.

Thanking you for all past favors, we are,

Yours very truly,

AMERICAN ELECTRO-PLATERS SOCIETY,

W. EHRENCRONA, Secretary.

Bridgeport Branch.

HARTFORD-CONNECTICUT VALLEY BRANCH

The Hartford-Connecticut Valley Branch, A. E. S., held its regular monthly meeting on Monday evening, April 28, 1930, at the Springfield Chamber of Commerce rooms, Springfield, Mass.

The meeting was called to order at 8:15 with President Beloin in the chair. Minutes of the previous meeting were read and approved. Two communications were read and placed on file.

Chairmen of the various committees appointed to handle the details of our Third Annual Educational Session and Banquet made their reports. From all indications, it looks as though it should be a big success. A fine list of speakers has been secured for the Educational Session, and an exceptionally good entertainment has been planned.

The question of analysis of plating solutions was discussed, and it was voted to accept the offer of the Hanson Van Winkle-Munning Co., who has offered to furnish a man with the necessary equipment to demonstrate the method of chemical analysis. A special meeting will be held in the near future for this particular work.

The members of the branch have formed the novel idea of having one or more members give a talk or write a paper on his particular type of work, then hold open discussion on his method of handling that particular work. In this way it is hoped that each member will learn something new that will help him in his own work. The first two members who volunteered to start the talks were Mr. Harry MacFadyen of the Arrow Electric Co., Hartford, Conn., and Mr. W. J.

Kennedy of The Westinghouse Electric and Mfg. Co. of Springfield, Mass.

Mr. George B. Hogaboom was then introduced, although the introduction was unnecessary, as his ability as a speaker is well known to the Hartford Branch.

Mr. Hogaboom gave a very interesting talk on Black Nickel. He gave a very interesting history of the development of the solution, the many kinds and methods used in working, and controlling the solution. He also gave much valuable data on the chemical analysis of the plating solution. His talk was very much appreciated, which was very evident by the large turnout of twenty-six members and visitors who came to hear him. In conclusion he was given a rising vote of thanks.

The meeting was adjourned at 10:30 P. M.

V. E. GRANT, Secretary.

MILWAUKEE BRANCH

The Milwaukee Branch held its eleventh annual banquet Saturday, April 26, 1930, at the Schroder Hotel, Milwaukee. The educational session started at 2:30 P. M., with Mr. H. Binder as chairman, and after a few words of welcome the following speakers were then introduced in following succession.

Mr. P. J. Lyons gave an interesting outline of plating room engineering, which the assembly seemed to greatly appreciate by the applause which greeted him. Mr. E. H. Bucy, next speaker, gave quite an outline on the decorative value of Lacquers, which was very interesting to the boys. Mr. Chas. Procter, founder of the society, sent in a paper on Hydrogen Pitting and Peeling of Nickel, which, in absence of Charles, was read by that good pinch hitter of Milwaukee branch, Mr. Seglitz; and the branch sure can feel proud of having help of such a willing and accomplished chemist. Next speaker was our good friend and worker, Mr. Jacob Hay, who gave us another of those wonderful talks upon the plating of Chromium in large production mass, which was filled with data and samples to illustrate the points indicated in his paper.

Mr. Harold K. Work, next speaker, gave an interesting outline of the methods of nickel plating on Aluminum as is being done in accord with the methods developed by himself and with a lantern and slides gave illustrated views of the deposition.

The last speaker of the program, our old friend and advisor of many hard winters in the plating game, was DAD LISCOMB, and as usual he brought home many things practical to the plater, but being cramped for time could not get the discussion up that he intended to bring home many of the things about the metals of which he spoke. And thus ended another of those educational meets that go to add things of value to the memberships of the A. E. S., and it sure is getting

more and more sure each year as we go on that the plater who isolates himself by not being a member of this society is sending himself into oblivion as a foreman and it is with regret that we see so many men in this profession who still live in the past state of darkness, and refuse through some fancy to be brought to light by joining the A. E. S.

The evening program started promptly at 7 o'clock with 140 members and guests in attendance. The entertainment by the National Quartet was one of the many features, the usual favors were dispensed and after the guests had blew themselves out on the balloons and exercised their arms on the clappers and noise makers, the food started to arrive and between the different courses dancing was indulged in by the assemblage.

The committee in charge of the affair is to be congratulated for the fine affair, in face of such a bad business condition that faces our industry at this time in the west, and is another reason why platers should be members of our society. It gives you courage to do things and instills confidence into your just as it has to the men in charge of the fine annual meet just concluded. Milwaukee branch is to be congratulated in having so many tireless workers in her vineyards.

. There were visitors and guests from Detroit, St. Louis and Chicago branches, and it was one happy party.

CORRESPONDENCE COMMITTEE.

NEW YORK BRANCH

The regular meeting of the New York Branch was held in the World Building, Park Row, New York City, on Friday evening, April 11.

The meeting was called to order at 8:45 o'clock by President F. Haushalter with all officers present. The minutes of the previous meeting were approved as read.

More new applications came in and these kept the trustees on the jump. We were all glad to see that our past president, Mr. MacStocker, was back with us again after his illness.

Supreme President H. Smith told about the resolution that Newark Branch is going to present at the convention this year about letting assistant foremen join the A. E. S. I am not so sure that the New York members are in favor of this. There will be a big discussion on this at the next meeting.

Four new members were elected into the branch, so we had a little sociable after the business of the meeting and everybody was feeling happy when the meeting adjoined at 11:30 o'clock.

C. HAUSHALTER, Recording Secretary.

The regular meeting of the New York Branch, A. E. S., was held

in the World Building, Park Row, New York City, on Friday, March 28.

The meeting was called to order by President F. Haushalter at 8:30 o'clock with all officers present and the minutes of the previous meeting were approved as read.

We are keeping our trustees busy at these meetings, going over the new applications that are coming in.

After the business of the meeting was over we had quite a discussion on chromium and gold solutions that lasted until a pretty late hour. Then the meeting was adjourned so that these platers who live in the suburban towns on Long Island, such as Stewart Manor and Freeport, could catch the last train leaving Brooklyn.

C. HAUSHALTER, Recording Secretary.

BALTIMORE-WASHINGTON BRANCH

The above branch held its regular monthly meeting Saturday, April 12, in the Enoch Pratt Library, Calhoun and Hollins St., Baltimore. President M. J. Kraft, presiding.

Our convention committees are working hard to make the coming convention a big success. We are doing our part. So, brother members, do yours. Do not forget. We will be waiting to welcome you all in Washington, June 30, July 1, 2, 3.

GEO. F. P. TURNER.

APPLICATIONS

	Branch
W. Sterling, 1025 Market St., Parkersburg, W. Va	Balt.-Wash.
Earl B. Ashby, 63 Wyllys St., Hartford, Conn	Hart.-Conn. Valley
Jos. Halgmyo, % Westfield Mfg. Co., Westfield, Mass	Hart.-Conn. Valley
Chas. F. Nesdry, 333 N. Fountain St., Allentown, Pa	Philadelphia
Chas. Muss, 4056 N. 7th St., Philadelphia, Pa	Philadelphia
Arthur Willink, Frankford Arsenal, Philadelphia, Pa	Philadelphia
A. W. Bosley, 6 Rosary Rd., Erdington, Birmingham, England	Philadelphia
Wm. Glass, 1129 Iowa St., Chicago, Ill	Chicago
Peter T. Irlbacker, 4101 W. 25th St., Chicago, Ill	Chicago
J. Wilson, % Covert Mfg. Co., Troy, N. Y	New York
A. Walker, Car Chain Mfg. Co., Troy, N. Y	New York

ELECTIONS

	Branch
W. Spinola, 51 E. 125th St., New York City	New York
P. Lucas, 5520 8th Ave., Brooklyn, N. Y	New York
D. E. Castle, 544 Willoughby Ave., Brooklyn, N. Y	New York
E. A. Woefel, % Western Clock Co., La Salle, Ill	Chicago

Wyley Monroe, Grand Hotel, Rockford, Ill.....Chicago
Jack Curry, 1317 N. 17th St., Melrose Park, Ill.....Chicago
Hy Perrin, 363 Cooke St.....Waterbury
Meyer Shacat, United Chrom. Corp.....Waterbury
Hy Zimmerman, Baseline P. O., Mich.....Detroit
Geo. H. Bartlett, 3518 E. Second St., Los Angeles, Cal.....Los Angeles
Chas. H. Houston, 649 Court St., San Bernardino, Cal....Los Angeles
Lea Roy Miller, 1358 S. Flower St., Los Angeles, Cal....Los Angeles
Hy J. Lack, 211 Neuters St., Boston, Mass.....Boston
Wm. G. French, 90 Roslindale Ave., Roslindale, Mass.....Boston
Earl B. Ashley, 63 Wyllys St., Hartford, Conn....Hart.-Conn. Valley
Robert Jorjorian, % Mathews Mfg. Co., 104 Gold St., Worcester, Mass. .....Worcester
A. E. Jorjorian, 133 Paine St., Worcester, Mass.....Worcester
Walter E. Finnegan, 8 Rollison Rd., Worcester, Mass.....Worcester
M. H. Froman, % Reed & Prince Mfg. Co., 1 Duncan Ave., Worcester, Mass. .....Worcester
V. H. Garrison, 60 S. Wildon Ave., Mansfield, O.....Dayton
Fred B. Murell, 438 6th St., Niagara Falls, N. Y.....Rochester
Gustave Mallow, 868 Fox St., New York, N. Y.....New York
Basil H. Green, 4 Doubleday St., Binghampton, N. Y.....New York
Samuel Geffon, 1821 Bryant Ave., New York, N. Y.....New York

REINSTATEMENTS

Branch

Ed. Stepka, 1541 S. 59th Court.....Chicago

RESIGNATIONS

Branch

P. W. Geiger, 5651 Belmar Terrace.....Rochester

DEATHS

Branch

Chas. F. Beck, Stamford, Conn.....New York

SUSPENSIONS

Branch

A. Posbeck .....Chicago
E. C. Gilman .....Chicago
O. Smeidel .....Chicago
O. T. Towner .....Chicago
Frank Colins, Ferndale, Md. .....Philadelphia
Jose D. Y. Canucis, Havana, Cuba.....Rochester
Andrew S. Groh, 607 Conkey St., Syracuse, N. Y.....Rochester
Peter W. Peiffer, 320 Clinton St., Syracuse, N. Y.....Rochester
R. G. Schneider, 168 Barberry St., Rochester, N. Y.....Rochester
Jno. Peiffer, 320 Clinton St., Syracuse, N. Y.....Rochester

BALTIMORE-WASHINGTON

Meets in Enoch Pratt Library, Calhoun and Hollins Sts. Geo. F. Turner, Secretary, 5324 Maple Ave., Pimlico, Baltimore, Md.

BOSTON

Meets at American House, Boston, Mass. First Thursday each month. Secretary Thos. Johnson, 41 first St., South Boston, Mass.

BRIDGEPORT

Meets first and third Friday of each month at Chamber of Commerce Rooms, Stratfield Hotel. Secretary, Wm. Ehrencrona, Box 301, R. F. D. No. 1., Bridgeport, Conn.

CHICAGO

Meets second Saturday of each month, at 8 p. m., Atlantic Hotel, 316 S. Clark St. Secretary, J. C. Kretschmer, 1914 Warner Ave.

CINCINNATI

Meets every Thursday, 7:30 p. m., at Vocational Training School, Spring and Liberty St. Secretary, Al. Yeager, 2021 Sherman Ave., Norwood, Ohio.

CLEVELAND

Meets first Saturday of each month at Hotel Winton. H. Terdoest, 380 Pioneer Ave., Akron, Ohio.

HARTFORD-CONN. VALLEY

Meets fourth Monday in each month alternately at 266 Pearl St., Hartford, Conn., and corner Broadway and Worthington St., Springfield. Secretary, Vernon Grant, 43 Putnam St., Bristol, Conn.

DAYTON

Meets first Saturday of each month at the Y. M. C. A., Dayton, Ohio. Secretary, Robert G. Suman. 2734 Ridge Road, Dayton, Ohio.

DETROIT

Meets the first Friday of each month at the Hotel Statler, Louis II Room, Detroit. Secretary, Chas. Phillips, 13421 Camden Ave., Detroit, Mich.

GRAND RAPIDS

Meets on the second Friday of each month at 528 Lake Michigan Drive, N. W. Secretary, Jacob Van Dyke, 1361 Union Ave., N. E., Grand Rapids, Mich.

INDIANAPOLIS

Meets the second Saturday of each month at Hotel Denison. Secretary, Louis Mertz, 1725 Union St., Indianapolis, Ind.

LOS ANGELES

Meets second Wednesday of each month at the Elite, 633 E. Flower St., Los Angeles, Calif. Secretary, M. D. Rynkofs, 1354 W. 25th St., Los Angeles, Calif.

MILWAUKEE

Meets second and fourth Thursdays of each month at Cor. 3rd St. and Highland Ave. J. N. Hock, 1229 W. 24th St., Milwaukee, Wis.

MONTREAL

Meets last Friday of month at Office of Secretary, John H. Feelay, 411 Aylmer St., Montreal, Quebec, Canada.

NEWARK

Meets first and third Fridays of each month at Franklin Hall, 41 Franklin St., Newark, N. J., at 8 p. m. Secretary-Treasurer, Geo. Rueter, P. O. Box 201, Newark, N. J.

NEW YORK

Meets every second and fourth Fridays of each month in the World Building, Park Row, New York City, N. Y. Secretary-Treasurer, J. E. Sterling, 2581 46th St., Astoria, L. I.

PHILADELPHIA

Meets first Friday of each month in the Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Sts. Secretary, P. Uhl, 2432 North 29th St., Philadelphia, Pa.

PITTSBURGH

Meets first Friday of each month at 8 p. m., at downtown branch, Y. M. C. A. Secretary, S. E. Hedden, 227 Fifth St., Aspinwall, Pa.

PROVIDENCE-ATTLEBORO

Meets first and third Thursday of each month at 44 Washington St., Prov. Engineers Rooms, Providence, R. I. Secretary, J. H. Andrews, 19 Rosedale St., Providence, R. I.

ROCHESTER

Meets every third Friday of each month at the Powers Hotel. Secretary, Chas. Griffin, 24 Garson Ave., Rochester, N. Y.

ST. LOUIS

Meets second Friday of each month at Central Y. M. C. A., 16th and Locust St. Secretary, C. T. McGinley, 8214 Fairham Ave., University City, Mo.

TOLEDO

Meets first Thursday of each month at Toledo Secor Hotel, corner Cherry and Page Sts. Secretary, L. D. Cope, 3747 Grantley Rd., Toledo, O.

TORONTO

Meets fourth Monday of each month at Canadian Foresters' Hall, 22 College St., Room No. 2. Secretary, H. W. Graham, 102 Robina Ave., Toronto, Canada.

WATERBURY

Meets the second Friday of the month at Engineers Hall, No. 11 East Main Street. Wm. F. Guilfoile, secretary, P. O. Box 961, Waterbury, Conn.

WORCESTER

Meets Directors' Room, Chamber of Commerce, Worcester, Mass. Roger H. Bryant, Secretary, 94 Grove St., Worcester, Mass.